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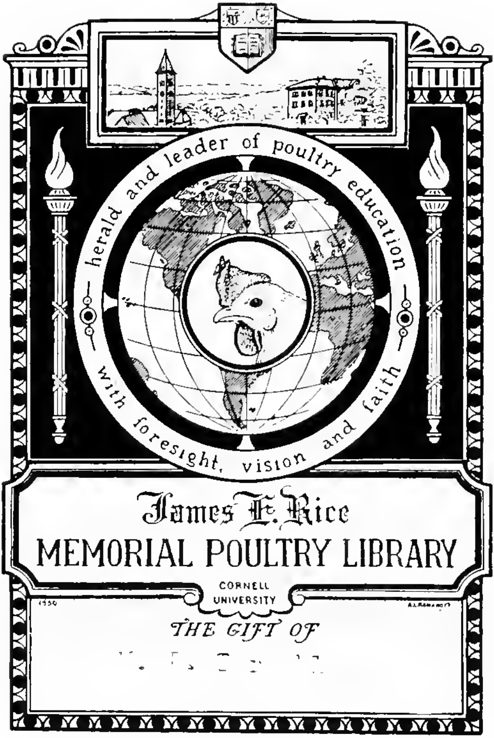

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**SECOND EDITION.**

# MODERN EGG FARMING

BY :

## F. C. ATKINS

**PRICE : 2/6**
(by Post 2/9).

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# *To my Readers.*

As this book has been so kindly received and the demand for it was still as brisk as ever when the first issue was exhausted, I have been encouraged to launch this new edition. The book was first published so recently that I have seen no occasion to alter any of the original text. This edition therefore differs from its forerunner only in that it is printed throughout in larger type.

The publication of the first edition brought me so many enquiries for hatching eggs, chicks and stock, that I feel no further excuse is needed for adding below a brief list of my prices for 1928. I am not a pedigree breeder, and can offer only good, honest commercial stock, bred for stamina and prolific laying powers, but with a keen eye of good type and colour.

**CANADIAN BARRED PLYMOUTH ROCKS (Imported 1926).**

EGGS—**£5** per hundred; **12/6** per dozen.
DAY-OLD CHICKS—**£8** per hundred; **20/-** per dozen.

**WHITE LEGHORNS and BLACK LEGHORNS.**

EGGS—**£2 10s.** per hundred; **7/-** per dozen.
CHICKS—**£5** per hundred; **12/6** per dozen.

**RHODE ISLAND REDS and WHITE WYANDOTTES.**

EGGS—**£3** per hundred; **8/-** per dozen.
CHICKS—**£6** per hundred; **14/-** per dozen.

**DAY-OLD PULLET CHICKS.**

Black Leghorn X Barred Rock
and
Rhode Island Red X Light Sussex—
**£9** per hundred; **22/-** per dozen.

**DAY-OLD COCKERELS.**

Rhode Island Red X Light Sussex Cross—
**£3 10/-** per hundred.

Black Leghorn X Barred Rock Cross—
**£2** per hundred.

I shall also be pleased to quote for Breeding Stock and Pullets.

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## CHAPTER 1.

## *Making a Start.*

VERY few fortunes are made from poultry, but thousands of newcomers since the War are making a good living from egg production. It would be useless to deny that there have lately been failures in the business; but that is because so many quite inexperienced men, in every way unsuited to a country life, took up poultry farming after they were demobilised. There was a big poultry boom then, and, now that the least capable of the post-war egg-farmers have found their inflated expectations without foundation and retired from the business in disgust, the reaction has set up a certain amount of depression in the poultry world. We are now back to something approaching pre-war conditions, and, in spite of the many poultry farms in the market, there is still ample margin of profit from egg production. The present time is, in my opinion, a much more opportune time to make a start than has occurred during the last six years or more. Values are now right down and there is no fear of the heavy capital depreciation which all who built their farms within a year or two of the Armistice have suffered. There are plenty of poultry farms to be had at reasonable prices now the boom is over and the prospects for the future have never been rosier than they now are.

For the benefit of those who are attracted by the life of a poultry farmer, but have no inside knowledge of the business, I will attempt to draw a picture of the egg-farming business as it really is, showing the capital needed and the profits that may be expected.

Let me commence by saying that an egg-farmer's life is not by any means the easy, lazy existence so often imagined by the outsider. It is a very busy life indeed and, though there is very little actual hard manual work, there is very little time for loafing. There are innumerable details to be constantly seen to, and success depends largely on the care and attention given to them. However, the work is full of interest, and to the man or woman who loves the country and the care of fowls, so fascinating that it never seems arduous. These two things are essential. A love of the country and the keenest interest in poultry—without them none should take up the business.

### THE CAPITAL REQUIRED.

The majority of egg-farms belong to the class somewhat loosely termed " one-man farms." This expression means a business in which no regular paid labour is employed. There are very few poultry farms indeed on which a solitary man or woman undertakes the whole of the work entirely unassisted by other members of the household. It is with " one-man " farms which I propose to deal in this chapter, as being suited to those who have only a moderate amount of capital at their disposal.

The first thing to be considered when planning to start an egg-farm is—what is the minimum income desired? In this connection it is well to note that the man who just exists in a town on a certain income will live well as a poultry farmer on a similar amount. The countryman, unlike the townsman, has no season ticket to buy or mid-day meal to be eaten away from home. Old clothes are the usual wear on the farm, and he spends far less on dress than the town dweller, who needs to be always smart. Rent and rates are much lower in the country, nor is there much opportunity to spend money on such amusements as theatres and cinemas.

A farm stocking 1,000 head of laying stock is about the limit in magnitude of a so-called " one-man " farm. A place of this size would call for a hand from one of the owner's household rather frequently, and, in the rearing season, a regular assistant would be required. A business of this size would absorb a capital of about £1,000 and take 1½ to two years to build up. The yearly profit should be in excess of £300, which is a very useful income in the country. The capital would be laid out approximately as follows:—

### PLANT.

| | | | |
|---|---|---|---|
| Laying houses for 1,000 birds (runs and fittings included). | £325 | 0 | 0 |
| Incubators and rearing appliances | 125 | 0 | 0 |
| Egg boxes, tools, small appliances and sundries | 50 | 0 | 0 |
| | 500 | 0 | 0 |

### LIVESTOCK.

| | | | |
|---|---|---|---|
| First Year— | | | |
| 100 Head of Breeding stock | 50 | 0 | 0 |
| Food for 500 pullets to maturity | 100 | 0 | 0 |
| Fuel for incubators and brooders | 15 | 0 | 0 |
| Rent and rates | 35 | 0 | 0 |
| Depreciation and Repairs | 15 | 0 | 0 |
| Sundries | 15 | 0 | 0 |
| | 730 | 0 | 0 |
| Second Year— | | | |
| Food for 500 layers at 10/- per head | 250 | 0 | 0 |
| Food for 500 pullets to maturity | 100 | 0 | 0 |
| Fuel for incubators and brooders | 15 | 0 | 0 |
| Rent and rates | 35 | 0 | 0 |
| Depreciation and repairs | 40 | 0 | 0 |
| Freight of eggs etc. | 20 | 0 | 0 |
| Sundries | 20 | 0 | 0 |
| | 1210 | 0 | 0 |
| *Less* value of eggs from 500 pullets (162 eggs per pullet at 1¾d. each) | 590 | 12 | 6 |
| | £619 | 7 | 6 |

As it would only be necessary to erect some £300 worth of the houses in the first 12 months, the actual outlay for the first year should not exceed £530. The second season, the expenditure would amount to £680, against which there would be an income of £590 odd. This shows only a total capital investment of £620; the remaining £380 balance of the £1,000 being available for the living expenses of the owner whilst the farm is being established.

The above estimate is based on a start being made in autumn with purchased breeding stock. The estimated rent and rates is liberal for poultry land, but is not intended to include the rental of the owner's dwelling house. Sundries would include such items as stamps and stationery, litter, disinfectants, medicines and other unforeseen expenses. I have not taken into account the cost of eggs used for hatching, food for the breeding stock purchased first year, or for deaths, but neither have I set down anything on account of the eggs laid by these breeders and their sale as old hens. I have allowed these receipts and outgoings to balance each other, though there should actually be a balance on the credit side. The food costs I have given are on the high side, and there would be room for economy in that direction.

The sum set down for houses is for up-to-date wooden structures erected by the owner with the assistance of a carpenter. Ready-made houses would cost considerably more, and cheaper buildings could be constructed. Laying sheds with felt walls and roofs, and earth floors ought not to cost more than about half this sum, though it would not be advisable to extend this economy to the brooders.

Other slightly different methods of making a start are by the purchase of 500 pullets in the fall of the year, or the purchase of hatching eggs or day-old chicks in the spring. It is usually more satisfactory to purchase breeding stock than to buy eggs or chicks. In a first rearing season, one is apt to have a number of minor disasters and losses, and these are much less serious when replacements can be hatched from one's own eggs, instead of being bought outside the farm.

The purchase of the first season's pullets already reared is a quicker method of starting, as the farm can then be established at full strength in little more than a year. Though good pullets about to lay are costly to buy, they may well prove a good investment when they save a year's living expenses, the rent of the farm and depreciation on buildings for the same period. Pullets always cost a lot to rear the first season, and I find, on referring back to my estimate of capital expenditure, that it runs to nearly 10/- per bird. When purchasing a large number, it should be possible to buy very good pullets for roundabout 12/6 each, and the 2/6 or so saved by rearing the stock oneself is but a poor reward for a season's labours. Moreover there is always some uncertainty about rearing the total number of pullets needed, and the purchase of reared birds removes any risk of a first season's shortage of layers.

### A WORD ABOUT THE PROFITS.

Once the farm is established, the yearly expenditure and receipts should work out much as follows—

### EXPENDITURE.

| | |
|---|---|
| Food for 1,000 layers | £500 |
| Cost of rearing 500 pullets (breeding cockerels, hatching eggs, food, fuel, etc.) | 130 |
| Rent and rates | 35 |
| Depreciation and repairs | 50 |
| Freight | 35 |
| Sundries | 25 |
| Total Outgoings | £775 |

### RECEIPTS.

| | |
|---|---|
| Sale of eggs from 1,000 layers (144 eggs per bird at 1¾d.) | 1050 |
| Sale of 450 old hens at 1/6 (10% death allowance) | 35 |
| Total Receipts | 1085 |
| *Less* Expenses | 775 |
| NETT INCOME | £310 |

The receipts estimated above are well on the conservative side, and nothing has been taken into account for revenue derived other than from the sale of eggs and old hens. On every farm there are a few additional items of income in the course of the year, such as the sale of manure, feathers, incubator clears, and possibly hatching eggs, day-old chicks, or stock birds. Such extras will provide a safe margin to cover any additional expenses not mentioned or not covered by "sundries." Egg receipts are based upon a very modest flock average. From skilfully bred and well-managed stock, a further 1/6 to 2/- worth of eggs per bird would not be a remarkable achievement. However, I am not attempting, in these estimates, to show the most successful results it is possible to get, but to give an idea of results which may be expected without special aid from fortune, or unusual skill.

I have allowed nothing for wages in my estimate, assuming that one of the owners' family will give most of his, or her, time to the poultry during the busy season. Without such assistance from the household, help must be hired. A lad, or young girl, would be quite capable of the work and would require a wage of 15/- to 20/- per week.

For the man who cannot fine £1,000 capital, and who is content with a very modest income, a 500 bird farm will provide a living. In this case, the capital expenditure on plant and stock would be half that of the 1000 bird farm, though rent and rates and living expenses, while the farm is in the building up stage, would be proportionately larger. A man with only £600 and no income would have to exercise considerable economy to make it cover the cost of establishing a 500 bird farm. He could expect to draw an income from the business of rather over £150 per annum, with the prospect of reaching the £200 mark as his knowledge of the business increased.

### CHOOSING A SUITABLE SITE AND BREED.

When choosing a site for an egg-farm, one must remember that economy of labour is of first importance, especially to the one-man poultry farmer. The chosen land should, therefore, be such that it can be laid out so that the incubator house, brooder houses and laying sheds are all within a conveniently short distance from the dwelling house. Good outbuildings are a great asset, as they will save the building of an incubator house, granary and store. An ample water supply is, of course, essential, as are good facilities for transporting supplies to the farm and getting the produce to market.

A damp, low-lying situation, or one that is exceptionally exposed, should be avoided, and the land should be moderately level. Perfect sites for poultry farms are hard to find, and, if an available piece of land fulfils the few requirements just mentioned, it is as well not to be too insistent on other advantages, such as light soil, a perfectly sheltered position and land sloping gently to the south. Many successful egg-farms have none of these latter advantages, and my own soil is a decidedly heavy one.

About five acres of land will be needed for an egg-farm with a stock of 1,000 laying birds, and a proportional area for a larger or smaller plant. Half the acreage will have to be devoted to the laying stock, and the greater part of what remains must be set aside as a rearing ground. A laying house for 400 birds will require two runs, each half-an-acre in extent. The back run for use during the summer months and the front one for occupation in the other half of the year.

In order to minimise work as much as possible, only one variety of fowls should be kept. White Leghorns are still the breed most widely used for egg production, but, owing to their very poor table qualities, they are less in favour than they were. Amongst dual purpose pure-bred stock, White Wyandottes stand out as egg producers. On a farm of modest size, and when the layers are run in flocks of not more than a hundred birds, they are probably superior to the White Leghorn.

Sex-linked crosses, the sex of the chicks from which can be detected at hatching, are now attracting a great deal of attention. If only because their use halves the labour of rearing, they are worthy of the serious consideration of every egg-farmer. Highly promising results have been obtained from the best of these crosses —notably the Black Leghorn and Barred Rock. The first-cross birds are very hardy, the pullets lay quite as well as the best of the pure breeds, the surplus stock fetches higher prices than pure light breeds, and the cockerels can be distinguished and got rid of as soon as hatched. A little extra work is occasioned by the necessity of keeping some pure-bred stock from which to breed the first-cross birds, but this is greatly outweighed by the saving effected in the labour of rearing, and of capital spent on brooding appliances.

## CHAPTER 2.

## *Housing.*

GOOD housing for the hens is absolutely essential to the most profitable production of eggs, for, if birds are to lay when eggs are scarce and fetch a high price, they must be provided with accommodation that will protect them from weather unfavourable to egg production.

The modern semi-intensive type of house, used on all up-to-date egg-farms, is much more than a roosting-place for the hens. Such a house is designed to provide a home for the birds, in which, should the weather be rough, they can be confined for several days at a time without a resultant falling off of the egg-yield. Although there are several types of semi-intensive houses in general use, and their holding capacity varies from six to 2,000 hens, the following features are common to them all:—

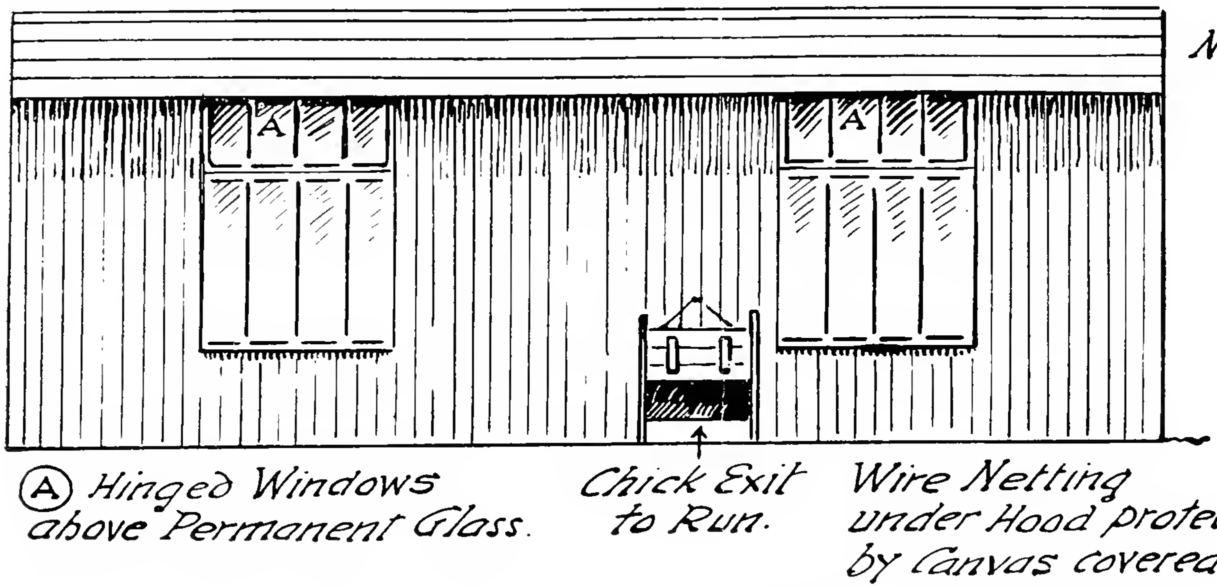
1.—They have a roomy floor space upon which the birds can get ample exercise.

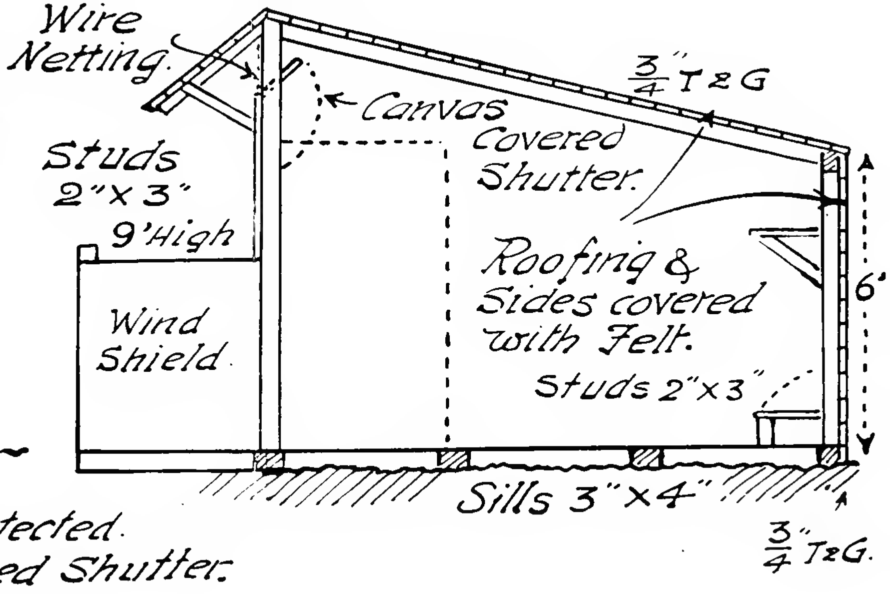
2.—They are very light, and their occupants can be kept active and busy all day long scratching for their food, which should be buried in several inches of litter. In a dark house, the fowls are sluggish and lazy, and, as a result, unproductive.

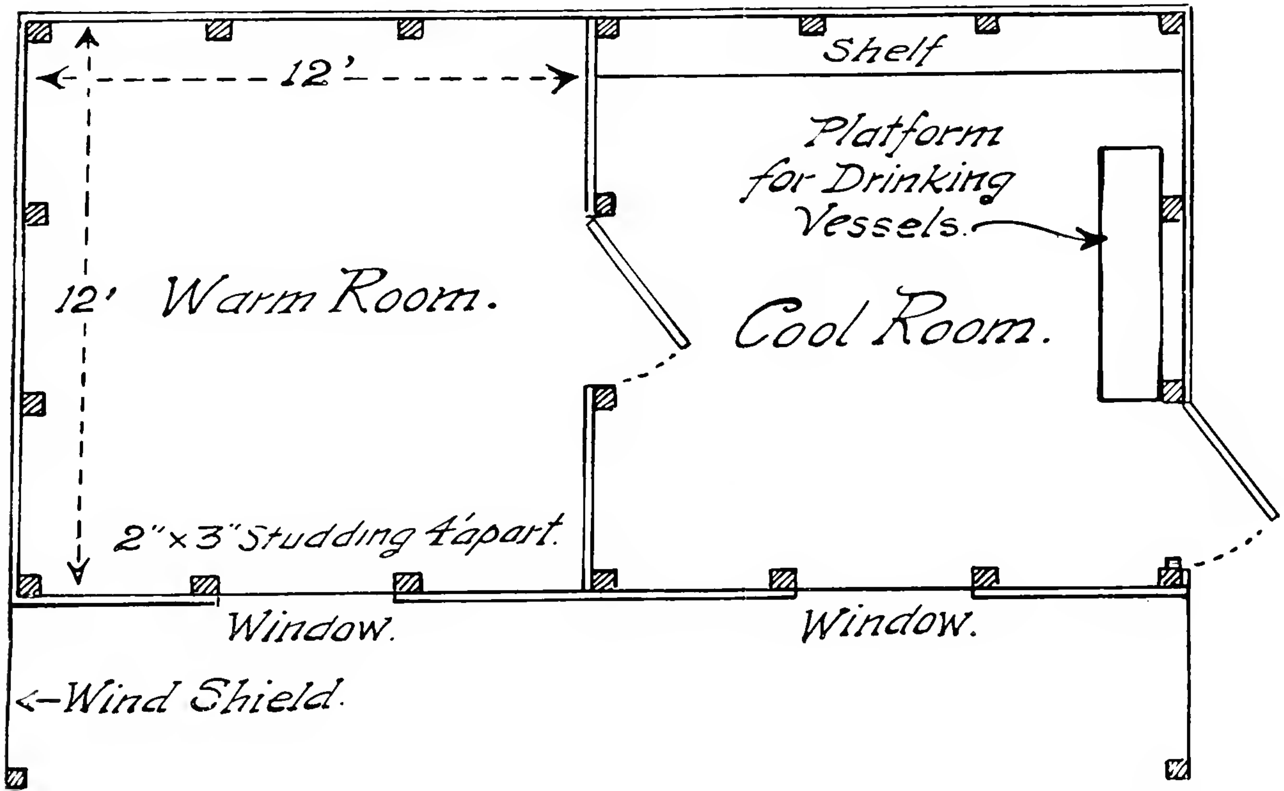
3.—They are well ventilated, and allow a free circulation of fresh air, without draught, which is very dangerous to the birds.

4.—They are dry and warm inside in the stormiest weather.

A very popular laying house, which leaves little room for improvement is illustrated in this book. The reader


A
A
Ⓐ Hinged Windows above Permanent Glass.
Chick Exit to Run.
Wire Netting under Hood protected by Canvas covered Shutter.





Plan of
TWO-COMPARTMENT
BROODER HOUSE

Scale 4 Feet to 1 inch.

will notice that the dropping-boards, nest-boxes, and other fittings are all raised clear of the floor, so as to allow the birds the maximum room for exercising. It will also be seen that the greater part of the front of the house is glazed, making the interior extremely light, whilst shutting out wind and rain. Ventilation is provided by the upper two feet of the front being left open, save for wire-netting, which should be small enough to keep out sparrows; and to prevent rain and snow from blowing in, a large hood projects over this opening. The perches and dropping-boards run right along the back of the house, which is airtight, and provide a warm and cosy roosting-place. The house is built in sections 20 feet long, divided off by draught-excluding partitions extending from floor to roof, and projecting to within 4ft. 9in. of the front of the house.

A row of detachable nest-boxes is placed along each side of the partitions dividing the house into sections, and on the end walls, on stands raised 1ft. 6in. from the floor. The mash and grit hoppers are attached to the lower and boarded part of the house front, as are the water troughs. It is not always possible to lay water on in a house, and when it has to be carted round, it is a good plan to arrange drinking vessels in boxes attached to, and projecting outside the front of the houses. It is then possible to replenish the water supply without entering the house.

Each 14 feet by 20 feet section of a house, as illustrated, will accommodate 70 hens, allowing each bird four square feet of floor space. Some egg-farmers keep as many as a hundred White Leghorns in one of these sections with quite satisfactory results, but it would not be wise to keep layers so closely housed until considerable experience had been gained in the management of laying stock.

Laying sheds of the lean-to type described are the most popular, and are so simple in construction that it is quite possible for poultry farmers with a little knowledge of rough carpentry to do their own building. Lean-to laying houses commonly used on egg-farms vary in depth from ten to twenty feet, 14 to 16 feet being a very usual size. The very deep houses are best suited to exposed positions, and are not well adapted to damp low-lying situations, as the birds perching at the back of the house will hardly get an adequate supply of fresh air. The narrowest houses are rather more expensive to build, as they absorb more material than a deeper house of similar capacity. Though once popular, ten feet deep laying houses are not much built nowadays.

The plan which appears elsewhere shows two 20ft. by 14ft. sections of the laying shed illustrated. All my own laying houses are built to this design, and vary in length from 40 feet to 160 feet.

In some instances it may be advisable to make slight alterations in the construction of this house to suit local conditions. For instance, in a very windy and exposed spot, it would be necessary to carry the glass higher up. In the early spring months, I used to be troubled with rain blowing in and wetting the litter, and so strong were the south-west gales that I have known the dropping boards at the back of the house to be running with water that had blown in under the hood. This had to be stopped immediately, and I found the addition of shutters ten inches deep, above the glass, quite effective. These shutters are removable and are only put up in rough weather. In a situation much exposed to winds, I should advise raising the glass front up to the bottom of the hood, or a few inches higher.

In exceptionally sheltered and low-lying districts, the ventilation allowed for in the plan would probably be insufficient, and some, or all, of the glass might be replaced with wire netting. The main object of the glass front is to keep wind and rain out, though it also helps to make the house warmer, and where there is nothing to be feared from these elements the cost of the glass can well be saved.

## KEEPING OUT RATS.

When building a house it is worth while taking some pains to make it rat-proof, as rats are always attracted by the plentiful supply of food in the fowls' quarters, and once well established under the floors, these vermin are extremely difficult to get rid of. Raising the house on bricks or stone piers one foot six inches high is about the easiest and best way to safeguard against rats and mice. Of course, with a building raised in this way, a board floor is the only thing. If the house is built direct on the ground, a floor can be made of several inches of chalk rammed down hard, or about three inches of concrete laid on rubble. A concrete floor should be tarred to keep the damp from rising through. I am strongly in favour of a wooden floor, raised well clear of the ground, and such a floor is often the cheapest. The labour in putting a chalk or concrete bottom to a house is very great, and unless most of the material can be found on the farm is not worth undertaking.

Several of my laying-houses have concrete floors, and under them rats will take up their homes, from which they are only turned out with great difficulty. In time, these pests will gnaw right through two inches of concrete into the house, even though they can more easily obtain access by making holes in the matchboarding from outside. The only practicable way to prevent rats lodging under, and boring through these floors, is to use a barricade of small mesh wire netting, which should be tarred to prevent rotting. A trench one foot six inches deep should be dug immediately round the walls of the house, and the netting attached to the house and stretched down the near side and floor of the trench, which should then be filled in. This will prevent burrowing under the floor, though an ingress is still possible through the side of the house.

When other methods have failed, rats can often be driven out, or destroyed in their holes, with the exhaust gases from a petrol engine. These fumes are extremely poisonous in a confined space, and rats will not return to a lodging-place that has been treated in this way for a very long time. The gas can be directed into a rat-hole by means of a hose-pipe attached to the exhaust pipe of the engine. All other holes should be stopped up.

### SIZE AND NUMBER OF LAYING HOUSES.

At least two laying-houses will be needed for each breed kept, i.e., one for pullets and the other for breeding stock. On fairly large farms it is often advisable to have a larger number, so as to be able to separate unmated hens from early and late hatched pullets, as birds of different ages do best if kept separate. White Leghorns, unlike other breeds, seem to do equally as well in flocks of anything up to two thousand birds, as in small groups of only one or two hundred. However, 500 bird houses are amply big enough for all but the very largest egg farms, and on those with not more than 1,000 layers, houses of half this capacity are more convenient. On farms employing other than a light breed, it is usual to split the fowls into flocks of 100, or less, birds, as the heavy varieties do not do so well when housed together in very large numbers.

## BROODER HOUSES.

I give in this volume a picture and a plan of one of my brooder houses heated by an anthracite stove. This design of brooder house is well suited to any type of large unit rearing system, and can also be used in conjunction with fireless brooders or indoor hovers, which can be divided off from one another with wire-netting. Each of my own brooder houses are built separately and stand in large wire-netting enclosed runs. Were I building up a new farm, I should erect them all adjoining—like sections of a laying house. This would save a certain amount of the attendant's time now taken in walking from one brooder house to the others. If a hot water brooding system of several units is to be installed, it is absolutely necessary that the houses should be built together in line, in order that only one boiler may be used to supply the heat to each lot of chicks.

It will be seen that the design of the brooder house is very similar to that of the laying shed, the only essential difference being that the wire netting above the glass is not so deep and is protected by a canvas covered shutter, which can be adjusted to regulate the ventilation.The measurements are 12ft. deep by 24ft. long, divided off into two rooms of 12ft. square ; it is 9ft. high in front and 6ft. at back, and allows ample head room for the attendant.

One of the two rooms contains the hover, the other is used as a cool room in which the chicks are fed, and from which they have access to the runs outside. When a number of brooder houses are erected together in a row, it would probably be advisable to supply alternate runs back and front. It is obvious that when a number of brooder houses are adjoining, the size, and particularly the width, of the runs are necessarily restricted.

## REARING HOUSES.

After the chicks leave the brooder houses, they should be transferred to small colony houses in flocks of from 50 to 150 birds according to the size of the house. It is probably as cheap to buy these colony houses ready made as it is to build them, and almost any of the popular much-advertised small poultry-houses are suitable for this purpose.

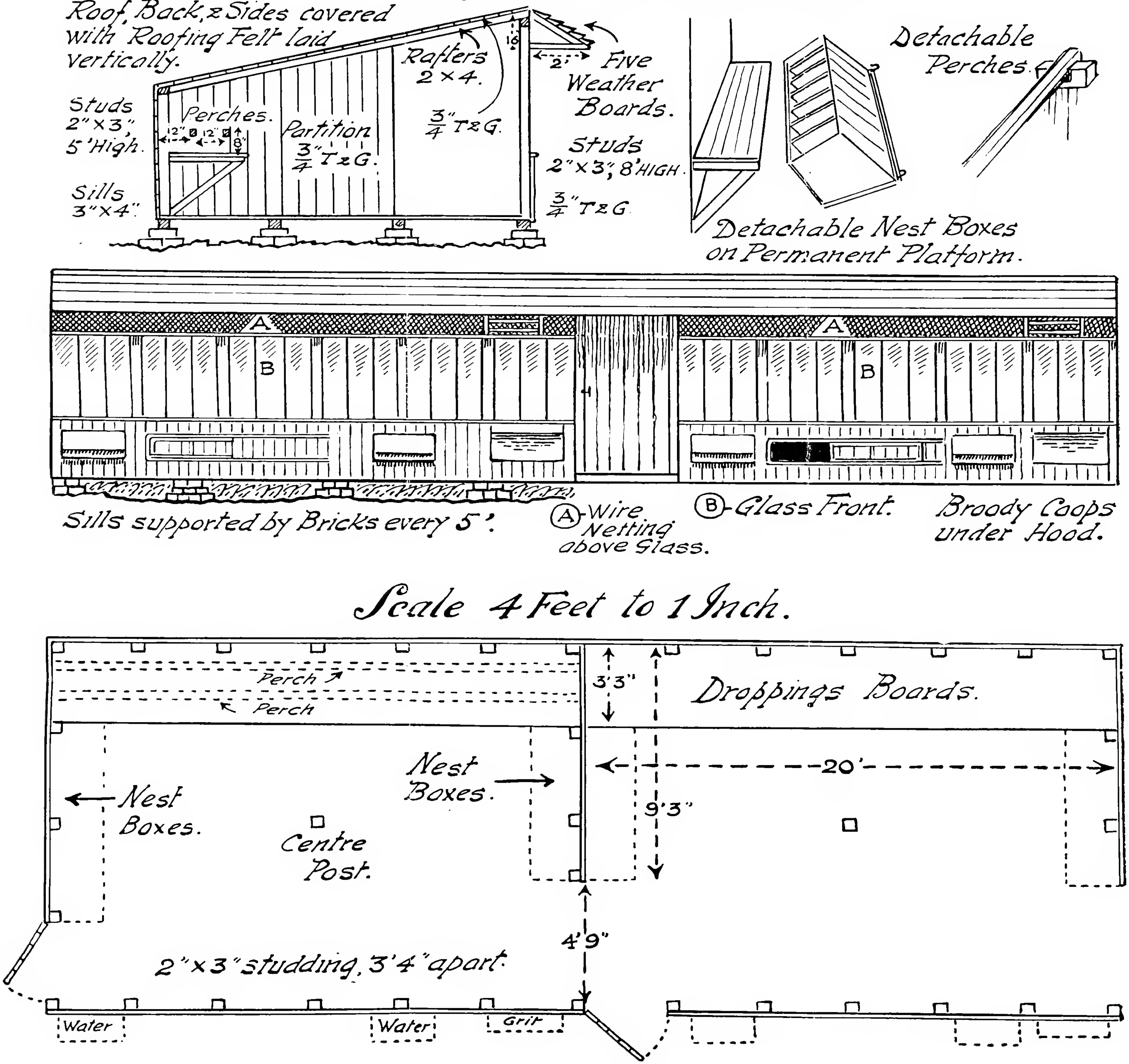
It is never wise to transfer a large number of chicks direct from the brooder into a large unheated house, as it will be difficult to keep chicks sufficiently warm at first to prevent them from crowding. Nothing is more annoying than to lose chicks after they have been reared to what is generally considered a "safe" age.

When my youngsters are ten to twelve weeks old, they are moved to a long house, rather like a miniature laying shed, though not so deep. The birds remain in this building until they are drafted into the laying shed, shortly before they come into lay. These large rearing houses, in which the pullets get used to running in large flocks, can be built much more cheaply than the laying sheds, as rough material can be used in their construction. For instance, weather boarding can take the place of more expensive match-boards, and, unless the position is a very exposed one, it will not be necessary to build a glass front to the house; wire-netting can be used instead.

## CHEAPLY-BUILT HOUSES.

Asbestos cement is a material much used by many poultry-farmers for their fowl houses. It is cheaper than wood, is a non-conductor of heat, and is draught and damp-proof; it has a hard smooth surface and provides no hiding places for vermin. The houses can be

# Plan of FORTY FOOT LAYING HOUSE.



built more quickly with this material than with match boarding, as it is erected in large slabs. Asbestos cement, however, requires rather careful handling and cutting, and will not bear much knocking about. I have three brooder houses made with this material and find them quite satisfactory.

The most cheaply built houses I have seen have been made of very thick roofing felt, stretched over a rigidly constructed framework; no boards whatever being used, except, of course, for the internal fittings. These houses, made of felt, are perfectly serviceable and wear extremely well if properly erected. The felt should be well supported, either by battens or by wire netting stretched tightly across the framework. Only the very best quality roofing felt should be used, and if it is given several good coats of tar and pitch mixed, it will become almost as hard and rigid as a board. One pound of pitch should be added to each gallon of tar, and the mixture applied hot.

When asbestos cement or felt is used to replace match boarding in the construction of a house, it is important that the framework should be strongly built and well tied, as neither of the two substitute materials give the same support and rigidity as do boards. Again, dropping boards, nest boxes, and all fittings will have to be fixed direct to the framework.

Earth floors are often used in conjunction with felt houses, and the whole makes an extremely cheap laying shed. If properly drained and well littered, earth floors will keep fresh and sweet for years. Should they become foul in the course of time, the top soil can be dug out and replaced with clean earth.

## CHAPTER 3.

# *Economical Feeding.*

THE purchase of food for the fowls is, by far, the largest item of expenditure incurred in the production of eggs, and the profits from the business will depend very much upon the use of sound and economical feeding methods. Everyone keeping fowls for profit should be able to work out a diet for the birds, which will produce the most satisfactory egg yield at the lowest possible cost. To do this, a knowledge is needed of the nutritive elements of all foods suitable for poultry feeding; the comparative feeding values of these foods; the proportion in which these nutritive elements can be most profitably given to the birds; and how to balance the ration so that the ingredients are correctly proportioned.

### THE COMPOSITION OF FOODS.

Chemical analysis of foods show them to consist of five classes of constituents :—

1. Albuminoids or protein.
2. Carbohydrates.
3. Fat or Oils.
4. Ash or mineral matter.
5. Fibre.

In addition, all foods contain a considerable amount of water—ranging from rather over ten per cent. in grains to about ninety per cent. in mangolds and swedes.

ALBUMINOIDS are bone, blood, muscle, feather, and egg formers. An egg is rich in protein, and it is not possible for a fowl to lay unless it can obtain albuminous matter, in excess of the amount needed for the maintenance of its body, for use in the formation of eggs. All cereals given to poultry contain some albuminoids, though not sufficient to make them perfect foods, if used alone. With birds on free range, this deficiency may be made up to some extent, if not entirely, by the insect and other animal food which they will find for themselves. When fowls are kept in large flocks, or confined to runs, the protein in their diet can be increased as desired by the addition to the mash of a food, rich in this substance, such as meat or fish-meal.

Foods chiefly valuable for the high percentage of albuminoids they contain are called albuminous or nitrogenous.

CARBOHYDRATES, which include starches, sugars, and cellulose, are heat and energy producers. Grains, such as wheat, oats, barley, maize, and dari, contain a high percentage of carbohydrates, and are called carbonaceous foods, for that reason. If more of these compounds are given than are needed to supply heat and energy, the surplus is converted into body fat.

FATS, OR OILS, serve the same purpose as carbohydrates, but are 2.3 times more powerful. That is to say, that a given quantity of a fat will generate more than twice the energy produced by the same amount of carbohydrates. Ordinarily, a laying hen needs only a small quantity of fat, and enough is obtained from wheat, oats, maize, and their products.

The use of very oily foods tends to cause over-fatness, and they are best avoided unless the birds are being prepared for the table or are feathering slowly after the moult. When the fowls are moulting, especially during a cold spell, a little hemp or sunflower seed, both grains of a very high fat content, assists the growth of new feathers, which contain a good deal of oil.

**Mineral Matter** in the form of lime, potassium, sodium, iron, magnesium, and phosphorus salts is found, usually in very small quantities, in practically all foods. With the exception of lime, the birds require only a very little of these salts, and as they are found in sufficient quantities in the foods used, the minerals present need not be considered in balancing a diet. Bones and egg-shell are very largely formed of lime, and it is advisable to ensure a plentiful supply by providing the birds with limestone grit, oyster, or cockle shell.

**Fibre** is most indigestible, and, therefore of very little nutritive value. The value of a poultry food depends upon the extent to which it can be digested by the birds. Nearly all vegetable matter contains a considerable proportion of carbohydrates, though it is not always in a digestible form. For instance, judged only from its chemical analysis, sawdust would be considered a valuable food. In actual fact, it is valueless as a feeding stuff, and harmful owing to its extreme indigestibility. As we have no reliable figures to show how far the various food stuffs used on the poultry-farm are digested by the birds, we must, in balancing the diet. assume each to be equally assimilable.

## THE ALBUMINOID RATIO.

Experiments have determined that in a model diet for laying birds albuminoids should be present in the proportion of one part to every four-and-a-half parts of carbohydrates. In other words, the "albuminoid ratio" should be 1 to 4·5. In very cold winter weather, more heat producers will be required, and then the ratio may be advantageously altered to 1 to 5. In actual practice it is not necessary to work out the proportion of protein in the birds' rations to a decimal point, and any variation between 1 to 4·3 to 1 to 4·7 is generally considered near enough to the ideal. As a matter of fact, absolute accuracy cannot possibly be obtained, because various samples of any one food-stuff usually give slightly different analyses.

It is, however, most important to get the albuminoid ratio approximately 1 to 4·5. If the albuminoids are deficient, the ratio is said to be a "wide" one, and when the opposite is the case, it is described as "narrow." Of the two errors, it is better to give rather too wide an albuminoid ratio than to give an excess of nitrogenous matter. If the diet is deficient in protein, the egg yield will suffer, and the birds become over-fat; but, unless the shortage is very great, they will suffer no permanent harm. On the other hand, the excessive use of albuminous foods is a great tax on the fowls' digestion, and, if persisted in, will result in kidney and liver disorders. Birds can to some extent use surplus protein to produce warmth and energy, though carbonaceous matter can never take the place of fish-formers.

Hens fed very heavily with nitrogenous foods may at first lay extremely well. They will, however, be drawing upon the reserves of fat in their bodies, and when this is exhausted, egg-production will cease altogether. If birds that are laying heavily begin to lose weight to any extent, the albuminoid ratio should be widened, as when eggs cease owing to the depletion of the fowl's body tissues, laying will not be resumed until the bird again gets into normal condition.

### WORKING OUT THE ALBUMINOID RATIO.

In order to be able to work out the albuminoid ratio of a diet, it is necessary to have an analysis table giving the percentage of albuminoids, carbohydrates, and fats in all the foods used. Such a table is given at the end of this chapter.

If the total amount of fats in each food stuff used in the ration is added together, and multiplied by 2·3 to express it in terms of carbohydrates, and these figures are added to the sum of all carbohydrates, and this total divided by the amount of albuminoids present in the diet, the result will be the albuminoid ratio.

To make this quite clear, I will take a popular diet for laying stock and work out the ratio. Generally speaking, a hen consumes four ounces, or rather more, of mash and grain a day. The total quantity eaten does not, of course, affect the ratio so long as we know the proportions in which the various foods are used. For the sake of simplicity, I will assume that the birds eat an equal amount, by weight, of wheat, and of the following mash, weighed dry:—

| | | | | |
|---|---|---|---|---|
| 3 | parts | by | weight of | Bran. |
| 3 | ,, | ,, | ,, | Middlings. |
| 3 | ,, | ,, | ,, | Sussex-ground Oats. |
| 1 | ,, | ,, | ,, | White Fish-Meal. |
| 10 | | | | |

The following figures (in percentages) are taken from the analysis table :—

| | albs. | carbos. | fats. |
|---|---|---|---|
| **Wheat** | 12·5 | 67·7 | 1·7 |
| **Bran** | 14·8 | 54·9 | 3·8 |
| **Middlings** | 15·6 | 60·4 | 4·0 |
| Sussex-ground Oats | 11·5 | 58·5 | 5·2 |
| White Fish-meal | 58·0 | — | 4·0 |

Carbohydrates are purely vegetable products, and are, therefore, not present in the fish-meal.

In order to discover the percentage of each of the three constituents in one part of the mash, it is necessary to multiply the figures given for bran, middlings, and ground oats by three, add to them the figures for fish-meal, and divide the whole by ten, thus :—

| | albs. | carbos. | fats. |
|---|---|---|---|
| 3 Bran | 44·4 | 164·7 | 11·4 |
| 3 Middlings | 46·8 | 181·2 | 12·0 |
| 3 Ground Oats | 34·5 | 175·5 | 15·6 |
| 1 Fish-meal | 58·0 | — | 4·0 |
| 10 | 183·7 | 521·4 | 43·0 |
| 1 | 18·3 | 52·1 | 4·3 |

As wheat and mash are used in equal proportions, we add together the percentages for each food.

| | albs. | carbos. | fats. |
|---|---|---|---|
| Mash | 18·3 | 52·1 | 4·3 |
| Wheat | 12·5 | 67·7 | 1·7 |
| | 30·8 | 119·8 | 6·0 |

Multiply the fats by 2·3 to reduce them to terms of carbohydrates.

| | |
|---|---|
| | 6·0 |
| | 2·3 |
| | 1·80 |
| | 12·0 |
| | 13·80 |
| Add the Carbohydrates | 119·8 |
| and divide by the | 30·8)133·6(4·3 |
| Albuminoids | 1232 |
| | 1040 |
| | 924 |

The albuminoid ratio is, therefore, 1 to 4·3.

In drawing up a menu for the fowls the desired albuminoid ratio can usually be most conveniently arrived at by adjustments made in the mash.

It is not quite so easy to prepare a menu that will give the desired albuminoid ratio, as it is to find the proportion of protein in an existing diet. This requires a little practice. The best way to set about it is: first to decide which of the carbonaceous foods are to be used, and in what proportion. A few experimental calculations can then be made to discover the exact amount of albuminous foods that must be added to give the correct balance. It is a good rule to lay down that the nitrogenous foods should never exceed ten per cent. of the total diet. Unless dari, maize, or other very starchy foods are used heavily, it should not be necessary to use as much as ten per cent. This is all to the good, since albuminous foods are generally more expensive and less easily digested than carbonaceous foods.

## ESSENTIAL POINTS OF A GOOD DIET.

Although every good diet for layers must contain one part of protein to about every 4½ parts of carbohydrates, a ration is not necessarily a good one because it is well balanced. Factors such as bulk, palatability, digestibility, and price have to be considered. As a rule, birds kept intensively do best on a bulky mash, as they have to consume a good deal to satisfy their appetites, and continual journeys between the mash hoppers and the water vessels serve to keep them busy and active. Fowls on free range will not spend much time at the mash hoppers, and should be given a fairly solid mash so that they can obtain the necessary nourishment in a short time. They will get exercise by foraging.

It is hardly possible for a fowl to eat too much of a well-balanced food, and any feeding stuff that tends to check appetite, because it is distasteful to the birds, is best left out of the diet. Sussex-ground Oats is an excellent food and very easily digested, but compared with similar stuffs—maize-meal, for instance—it is dear. Were the price more favourable, I should use ground oats in my laying mash in preference to other similar foods, because of its superior digestibility.

The percentage of fish-meal or other nitrogenous foods used in a diet, will naturally depend upon the starchiness of the other ingredients. In the specimen ration given, five per cent. is fish-meal. If, however. maize-meal were used in the mash instead of Sussex-ground oats, and the grain feed changed from wheat to maize, about double the quantity of fish-meal would be needed to give the same albuminoid ratio. Other considerations being equal, the mash containing the smaller quantity of fish-meal is to be preferred as imposing less strain on the digestive organs.

## COMPARING THE NUTRITIVE VALUE OF FOODS.

In order to feed at the lowest cost we must use the meals and grains which supply nutriment in the cheapest form. Unfortunately, we do not know exactly what proportion of any food is digestible—(the digestive co-efficient)—and we are unable to make any very close comparisons of nutritive values.

## " BULKY " FOODS and " SOLID " FOODS.

Feeding meals can be divided into two classes according to their density, *i.e.*, " bulky " and " solid " foods. Bran, middlings, and clover-meal are typical examples of the first class, while ground oats, maize, barley and dari, fish and meat-meals, belong to the latter order. All good mashes contain both " bulky " and " solid " meals. The former are necessary, as it were, to " dilute " the heavier meals, and present them in a more digestible form. The majority of mashes contain from thirty per cent. to sixty per cent. of bran and middlings together. As a " bulky " food can never properly take the place of a " solid " food, it is not necessary closely to compare feeding value between these two classes of foodstuffs. Any such comparison is apt to be misleading. As an example: The study of the chemical analysis of middlings and ground oats gives the impression that the respective food values of these two foods are not far apart. However, if middlings were substituted for the ground oats in a diet, inferior results might be expected from the altered ration.

Of the " bulky " foods, bran and middlings are mostly used together. They are the cheapest of this class of foods, and are included in most mashes. Other " bulky " footstuffs, such as clover-meal and malt dust, when they form part of a diet, are included not so much for their nutritive value as for some special property which they possess. Malt dust is said to aid digestion, and clover-meal can partly make up for lack of fresh green food. Malt dust might be used to re-place some of the bran in a mash, provided the price was much the same. Middlings is a most useful food which it is hard to do without; however, when it is too dear, as is sometimes the case, its place in the mash can then be taken, partly by another " bulky " food (such as bran or clover-meal) and partly by one of the solid meals.

No comparison can be drawn between the feeding values of a carbonaceous and a nitrogenous food, as they belong to entirely different classes, neither of which can replace the other, and both are necessary in a diet. A small quantity of fish-meal, or other albuminous food, added to a mash deficient in protein, will greatly increase the value of the whole.

## CARBONACEOUS FOODS.

When comparing carbonaceous food such as ground oats, maize, barley, and dari-meals, the nutritive value of each can be assumed to be, very roughly, equal. If the price of these meals was the same, my choice would fall on ground oats, as it is the most easily-digested of the four foods. This digestibility is probably due, in some part, to the very good grinding which is a characteristic of the genuine Sussex-ground oats. Unfortunately, ground oats is almost always the most highly-priced of this class of foods. Dari-meal is not very generally used, and the supply is uncertain, hence maize-meal and, (or) barley-meal often proves the cheapest form in which to supply the main energy-producing ingredients of the mash.

## NITROGENOUS FOODS.

Certain vegetable products, mainly leguminous, such as pea, bean, and clover-meal, can be classed as nitrogenous foods, but, as a rule, the protein in the diet is best supplied in the form of animal matter. Specially prepared fish or meat-meals generally provide the cheapest and most digestible albuminoids. A good white fish-meal contains sixty per cent. of albuminoid, while in most meat-meals the percentage is forty per cent. to forty-five per cent. As both these foods are bought solely for the protein they contain, a fish-meal of sixty per cent. albuminoids, and costing £1 per cwt., and a meat-meal of forty-five per cent. albuminoids at 16/- per cwt., would be of approximately the same value.

## CHOOSING A FISH-MEAL.

Fish-meal should be bought with care, as there are plenty of cheap brands on sale which are quite unfit for food. A really good fish-meal should be manufactured entirely from white-blooded fish, and guaranteed to contain over 55 per cent. albuminoids and not more than 2 per cent. to 3 per cent. of salt and 4 per cent. of oil Meals made from red-blooded fish, such as herrings, are very oily and excessively salt. They are only fit for manure. Salt, except in very small quantities, is almost as harmful to poultry as to pigs. A good sample of fish-meal is dry, free from lumps, and of rather a light brown colour.

## GRAIN FOOD.

The most popular grain foods are undoubtedly wheat, oats, and maize. Fowls are not fond of barley given whole, and it is always a bad policy to supply anything which the birds eat with reluctance. I have had practically no experience of dari, which I should imagine has much the same nutritive value as maize.

MAIZE is richer in carbohydrates, and, therefore, more heating than either wheat or oats. It is an excellent food for use in cold weather, though it can be used quite safely all-the-year-round provided the whole diet is properly balanced.

OATS very often appear cheaper than is actually the case, and in comparing them with wheat and maize, it should be remembered that they have a good deal of fibry husk, much of which is probably indigestible. Grey Winters are oats which usually represent the best feeding value. Although somewhat light in weight they have a very thin husk, and in addition, this class of oat is usually lowest in price. The plump white oat, so often selected by poultry-keepers, is usually dear, and contains less kernel than would be expected, owing to the very thick husk.

WHEAT is a splendid all-round food, and birds will do well on tail, shrunken, damp, or other wheat below milling standard. "Smutty," or badly-heated wheat, should never be given to fowls.

### KILN-DRIED WHEAT.

In most ship-loads of wheat some part of the grain gets damaged by water. When properly kiln dried, such wheat often makes a cheap and serviceable poultry food, the use of which is a great aid in keeping down feeding costs. Supplies of this grain are rather limited, and I should not advise poultry-keepers to start feeding kiln-dried wheat unless they are reasonably sure that they will be able to get regular consignments.

Kiln-dried wheat is not at all appetising in appearance, and usually has a rather unpleasant smell. Birds fed regularly with it eat it well, and I have never found any harmful results from its use; but the hens naturally prefer undamaged grain, and if kiln-dried wheat is given alternately with best wheat, some difficulty will be found in making the birds pick up the less palatable food, and this will surely affect the egg yield. I sometimes have had to buy damaged wheat at a price above its real feeding value, because I know that if I start to use sound grain I shall have to continue to do so or get into difficulties when I attempt to give kiln-dried wheat once more. As samples of kiln-dried wheat vary very much, and only some of them are fit for supplying to fowls, considerable discrimination is needed in purchasing this damaged grain.

### CHOOSING A KILN-DRIED WHEAT.

For the guidance of readers who may think it worth their while to give damaged wheat to their birds, I will give a few hints on purchasing this class of food. Much of the kiln-dried wheat offered for sale is not fit for poultry food, and even the best samples do not have a very promising look. Almost all these wheats are very dark—a dirty colour—and none of them smell very fresh. At first sight, the majority of poultry-keepers would discard them as useless. Samples of damaged wheat should be very carefully examined before a purchase is made. A kiln-dried wheat that has a mouldy appearance should be discarded; so should one that is very dusty or mealy. In some cases, a good many of the grains will be found to be soft and in others very salt. Either fault will disqualify a sample for poultry feeding.

as would a very strong smell. In a really good lot of damaged wheat, every grain should be hard and dry, and quite sound inside, though externally it will probably be much discoloured.

### WET OR DRY MASH?

Mash can be given wet or dry. The latter is the more modern method, and was, I believe, originated in America. Dry-mash feeding has been adopted very largely by commercial poultry-keepers, as it can be given more conveniently and involves less labour than the supplying of wet mash. However, there are still many poultry-farmers who prefer to give their mash wet, and it undoubtedly has some advantages.

Two poultry-keepers, one a dry mash feeder and the other who relied on wet mash, might argue together in favour of their respective methods somewhat after this fashion :—

THE DRY-MASHER : " Dry mash feeding saves me a lot of time, as I only fill my hoppers once a week, whilst you have to prepare and give your wet mash every day."

THE WET-MASHER : " I admit it saves time to give mash dry, but in these cold mornings all my birds get a good hot meal to start the day with."

THE DRY-MASHER : " My birds get plenty of exercise to keep themselves warm, scratching for their grain, and in frequent visits between the mash hoppers and water vessels. Your birds may get a hot meal, but they gorge it all down at once, and then, being satisfied, hang about instead of exercising themselves."

THE WET-MASHER: "Wet mash has other advantages; for instance, I cook all the carbonaceous foods and that makes them more digestible, and as the birds get more nourishment from an equal quantity of food, mine is the cheapest way to feed."

THE DRY-MASHER: "I know cooking starchy foods makes them more easily digested, but it has just the opposite effect upon albuminoids, and all the carbonaceous foods contain some protein."

THE WET-MASHER: 'I can use vegetables grown on the farm in my mash; you can't economise in this way if you dry feed."

THE DRY-MASHER: "If you are going to put all sorts of vegetable stuff in your mash, how can you expect to balance your diet properly? My birds get all the greenstuff they want without having it crammed down their throats, as it were. A good part of your mash is water—mine's nearly all food."

THE WET-MASHER: "You forget that my cooked mash is more digestible and not so likely to cause bowel trouble as yours."

THE DRY-MASHER: "I don't entirely agree with you there. You know what happens if your mash happens to be a bit too sloppy. The birds get diarrhœa. Besides, all your hoppers soon get sour unless they are frequently and carefully cleaned, and sour food can't do the birds any good."

THE WET-MASHER: "Anyway, I get just as many eggs from my birds as you do from yours—more if anything; and if I spend more on labour, my mash works out a bit cheaper than yours, which helps to square things."

## ARRANGING AN ECONOMICAL DIET.

I am convinced that very many poultry-farmers do not give sufficient consideration to the economical feeding of their birds. Foods should only be purchased when the price is such that they represent the cheapest form in which the nutriment required can be bought. The poultry-keeper who is unable to work out a balanced ration for his birds, and therefore has to depend on one or two stock mashes, is at a great disadvantage, because his choice of ingredients is limited, and he will have to purchase them, however dear. If he is able to balance a diet, he can study his price list, choose the cheaper foods, and work out the correct proportions.

Feeding costs can often be reduced considerably by making a slight alteration in the mash. As an example, let us take the following formula and see if it is possible to cheapen it by substituting some of the ingredients with others less costly. All the prices I give for the meals named below are taken from the same issue of the "Farmer's Express."

| Cwt. | | Price. | | Total. |
|---|---|---|---|---|
| 3 | Bran ... ... ... ... | at 7/- | = | 21/- |
| 3 | Middlings ... ... ... | at 8/3 | = | 24/9 |
| 3 | Sussex-ground Oats ... | at 13/9 | = | 41/3 |
| 1½ | Meat-meal ... ... .. | at 17/- | = | 25/6 |
| — | (42 per cent. Albuminoids) | | | —— |
| 10½ | | | | 112/6 |

One cwt., therefore, costs approximately 10/8

The above is an excellent mash, but Sussex-ground oats at 13/9 is dear, when compared with maize-meal at 10/3, and the 1½ cwt. meat-meal (42 % albuminoids) at 17/- can be replaced by only 1 cwt. of white fish-meal

(60 % albuminoids) at 18/6 without materially altering the albuminoid ratio. The altered mash then works out as follows:—

| Cwt. | | Price | | Total. |
|---|---|---|---|---|
| 3 | Bran ... ... .. ... | at 7/- | = | 21/- |
| 3 | Middlings ... ... ... | at 8/3 | = | 24/9 |
| 3 | Maize-meal ... .. ... | at 10/3 | = | 30/9 |
| 1 | Fish-meal ... ... . | at 18/6 | = | 18/6 |
| — | (60 per cent. Albuminoids) | | | ——— |
| 10 | | | | 95/- |

One cwt. costs 9/6, which represents a saving of 1/2 per cwt., both mashes being of almost equivalent feeding value.

### GREEN FOOD.

Fowls require a regular supply of fresh green food to keep them in perfect health. Birds on free range will find all the greenstuff they want for themselves, but when their liberty is restricted some provision will have to be made to ensure the supply. My own laying houses are all provided with two runs, back and front, which the birds are allowed to use alternately. Each run, when unoccupied, is sown with kale or rape, so that there is a continuous supply of growing green food to which the birds can help themselves. In addition, this cropping of the runs absorbs the manure distributed by the birds, and so keeps the land sweet.

Clover, lucerne, and similar leguminous plants are said to be specially good for fowls, as they are highly nitrogenous. The birds, however, seem to prefer grass of all greenstuffs, and when this is available very rarely touch the legumes. I have seen the grass in a poultry run eaten down close to the ground, and in the same yard a number of lucerne plants quite untouched by the birds.

## VITAMINS.

Recently vitamins, of which there are several known varieties, have come very much into prominence, and the subject has received considerable attention from the more scientific poultry-keepers. As yet, very little is known about these rather mysterious substances, but it has been discovered that they are absolutely essential to good health in all classes of livestock, and particularly to youngsters.

The absence, or deficiency, of vitamins in a diet is the root cause of most malnutrition diseases; but fortunately the fowls' requirements in this respect are supplied in most well-balanced diets. It is usually only in exceptional circumstances that it becomes necessary to add foods specially rich in vitamins to the menu. Such foods are more likely to be beneficial to chicks, as all growing stock has special need of these vital substances.

The following foods are specially rich in vitamins: Cod liver oil, yeast, new milk, eggs, and fresh green-stuff.

## GRIT.

If the gizzard of a dead fowl is opened, it will be found to contain a quantity of small pebbles and fragments of stone. This grit is picked up, and used by the birds to help grind up their food, and it is sometimes described as the birds' " teeth." Birds of all ages should have constant access to some sort of grit, preferably one containing lime, much of which is needed by the birds for conversion into egg-shells. Many poultry-keepers use both flint grit, and oyster or cockle shell. One of the most convenient forms of grit is broken limestone, as this will take the place of both flint and oyster shell.

Poultry-keepers are often recommended to use the sharpest flints they can find; the idea being that the sharper the grit is the better will be the bird's digestion. I have used nothing but limestone grit and cockle shell for years, and I am inclined to think that very sharp grit is of too irritant a nature to be good for the birds, and it is certainly unnecessary. I have found from observation that such grit very quickly passes through the fowls.

**THE WATER SUPPLY.**

Fowls, especially those fed on dry mash, drink a good deal of water, and it is most important that they should have a constant supply. Drinking vessels should be cleaned out, and fresh water given every day. Many up-to-date egg-farmers have water laid on all over their farm and carried direct to their laying houses. Water troughs should always be kept shaded, as sun-heated water is sometimes the cause of bowel trouble, more especially among the chicks.

## ANALYSIS TABLE OF FOODSTUFFS.

| Food | Albuminoids. | Carbohydrates. | Fats. | Ash. | Fibre. | Water. |
|---|---|---|---|---|---|---|
| **Wheat** | 12·5 | 67·7 | 1·7 | 1·8 | 2·4 | 13·9 |
| **Bran** | 14·8 | 54·9 | 3·8 | 5·8 | 8·1 | 12·6 |
| **Middlings** | 15·6 | 60·4 | 4·0 | 3·3 | 4·6 | 12·1 |
| **Oats** | 11·5 | 58·5 | 5·2 | 3·0 | 9·7 | 12·0 |
| **Barley** | 12·4 | 69·8 | 1·8 | 2·4 | 2·7 | 10·9 |
| **Maize** | 9·2 | 68·0 | 5·1 | 1·4 | 2·6 | 13·7 |
| **Dari** | 15·0 | 61·5 | 5·0 | 1·6 | 3·9 | 13·0 |
| **Canary Seed** | 13·8 | 50·7 | 5·4 | 6·8 | 8·2 | 15·1 |
| **Hempseed** | 16·3 | 15·0 | 30·0 | 4·4 | 22·0 | 12·3 |
| **Linseed** | 20·5 | 19·6 | 37·0 | 3·4 | 7·2 | 12·3 |
| **Malt Dust** | 23·0 | 42·2 | 2·5 | 6·8 | 17·5 | 8·0 |
| **White Fish-meal** | 58·0 | — | 4·0 | 5·0 | — | — |
| **Meat Meal** | 42·0 | — | 13·0 | 4·0 | — | — |

NOTE. — The analysis of different samples of most foods vary a little, hence, in nearly all analysis tables the figures given for the same foodstuffs differ slightly. Fish-meal and meat-meal should always be bought with a guaranteed analysis, as different brands of these two foods vary greatly in feeding value.

## CHAPTER 4.

# *The Care of Laying Stock.*

### MAKING HENS WORK.

THE modern, well-bred hen lays far more eggs than it is natural for a fowl to produce when in the wild state, consequently the present-day layer has to consume an abnormal quantity of concentrated food in order to maintain production. To keep such birds in perfect health, and their digestive organs functioning properly, they must be forced to take as much exercise as possible. So as to make the fowls work, poultry-keepers now cover the floor of their laying-houses deeply with litter. The grain feed is well scattered and buried in this litter, and the birds have to scratch hard to find the food. My birds have their grain in two nearly equal portions, given at 7.30 a.m. and 3.30 p.m. Dry mash is always before the birds in open hoppers.

Most poultry-farmers now give two grain feeds, as it makes the birds exercise more; but, where there is ample free range, the fowls should find plenty of occupation away from their houses, and then the corn need only be distributed once a day. In this case it is best to give the birds this meal in the afternoon, as it is important that they should go to roost with full crops. If grain is given only in the morning, the hens will partially satisfy their appetites early in the day, and so be less inclined to sally forth in search of food. Feeders of wet mash usually give the mash in the morning and the corn in the latter half of the day, though some reverse this procedure, as they think, quite rightly, that the birds might not get enough exercise if soft food only is supplied until the afternoon. Also, in cold weather, they are able to supply a last meal of warm mash. The only disadvantage to this method seems to be that the mash, being rather quickly digested, does not last the birds so long through the night as corn would.

### LITTER.

The best litter for the laying-house is long straw, and it should be kept from three to six inches deep. Straw should never be cut up. The birds will do this themselves in an amazingly short time, and it will be necessary to add fresh supplies from time to time. Provided it does not get damp, the same litter can remain in the house for several months, it only being necessary to make occasional additions to maintain the depth. Some poultry-farmers put a foundation of six inches of sand on the floor, and lay straw on top. The sand helps to keep the litter dry, and when it is used the whole is removed only once a year. I have no sand on my farm, and should have to buy it and cart it a considerable distance, and I have never used it, because of the expense, and for one other reason. Sand is very heavy stuff to shift, and the removal of six inches of it, together with a year's accumulated litter is no small task. It is not a very heavy job to clear out a house if sand is not used, and it suits my labour arrangements to do this four or five times a year rather than have one much more formidable annual clearing-up.

## KEEPING LAYERS "IN THE PINK."

The successful management of laying stock depends very much upon the keen observation of the birds, and a good attendant should be quick to note the slightest change in the condition of the fowls. To lay their best, birds must be in perfect physical tune, and it is much easier to keep them fit than to tone them up when they have got out of condition. Hens " in the pink " and laying heavily are very alert, bright, and active, and their combs are a brilliant scarlet. The colour and fullness of the comb is one of the best indications of a fowl's state of health, and though an unproductive hen may sometimes have the bright comb of a bird in full lay, a small, shrunken and dull-looking comb is a sure sign that a fowl is not laying. Except when moulting, it should be possible to keep the laying stock in productive condition all the year round; and if this is to be done, any tendency to fall away should be noticed immediately, and this necessitates constant close observation.

If there is the slightest suspicion that the birds are not quite up to the mark, the cause should be sought at once. It is always advisable to handle the birds pretty frequently to make sure that they are not losing weight or growing too fat. Some birds will get fat on a diet exactly suited to the great majority of the other fowls, and so the condition of the birds as a flock must be taken into account, and not just individuals.

If birds are too thin, it is a sure sign that the carbohydrates in the ration are deficient, and they must be increased. Too much of the starchy elements in the birds' food will cause overfatness, though this is very often caused through insufficient exercise. If birds don't seem very eager for their grain, it is a sure sign that something is not quite right. Very often cutting down the corn for a day or so will be all the adjustment needed.

## COLDS AND THEIR TREATMENT.

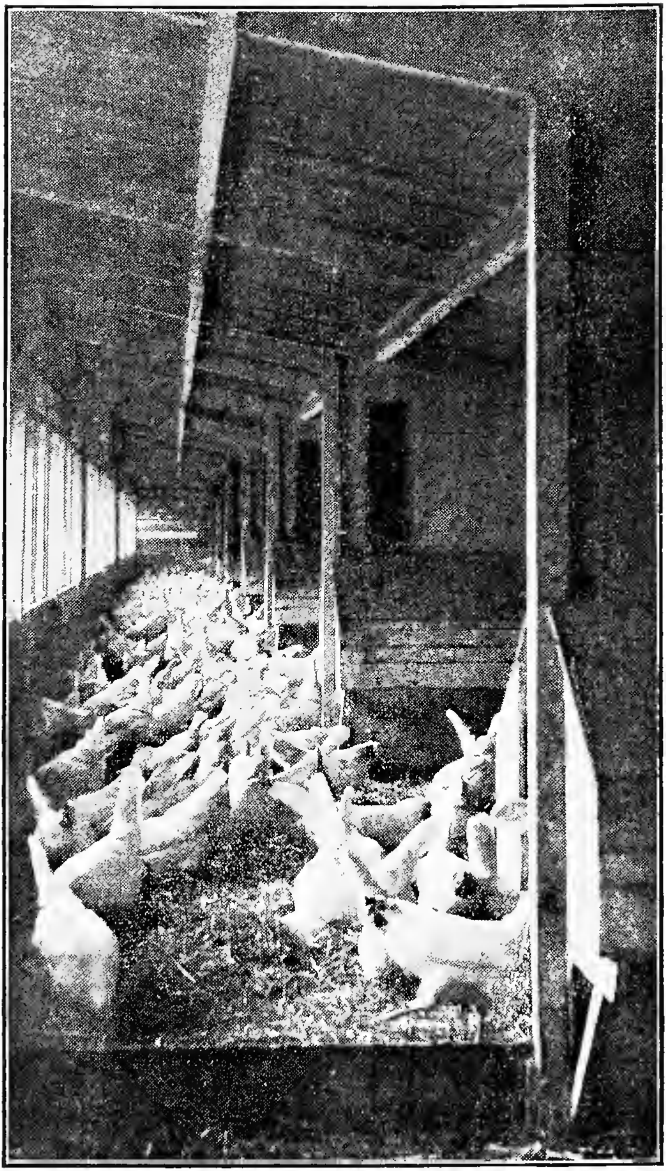
A very great deal has been written about poultry diseases, and a study of the various ailments with which fowls are sometimes afflicted is almost enough to frighten off prospective poultry-keepers; but the truth is that if they are kept on the right lines the birds should never contract any serious diseases. Fowls are more subject to colds than anything else, and these are most often caused by damp litter or draughty perches. These colds are easily checked, if taken in time, and can usually be first detected by an occasional sneeze or cough from one or two of the birds in the flock.

Although when discovered the colds will probably be confined to only a few of the birds, it is best and easiest to treat the whole flock without removing the affected birds. Sulphate of copper given in the drinking water is one of the best medicines, and it is advisable to keep a stock for use in emergencies.

Sulphate of copper can be bought from any chemist, at a very small cost, in crystal form. One ounce of these crystals to every ten gallons of drinking-water is a mild and usually effective dose. In severe cases, the strength may be doubled. If the colds are very severe, several doses may be necessary to effect a complete cure.

In such circumstances, it would probably be best to give a strong dose first, and milder ones on alternate days afterwards. Sulphate of copper is an astringent, and can also be used as a treatment for diarrhœa. This

160FT. x 14FT. LAYING SHED, HOUSING 500 WHITE LEGHORNS.



INTERIOR OF THE HOUSE ILLUSTRATED OVERLEAF.

medicine turns the water greenish blue. The birds don't like it very much, and it is not advisable to use it for several days running for this reason. It is a poison, so must be handled rather carefully.

If sulphate of copper is given in metal drinking vessels, it will in time eat away the metal, which to some extent robs it of its effectiveness. However, this effect is very slight, and although poultry-books nearly always state that it should only be supplied in earthenware vessels, I use it in my metal troughs with perfectly good results.

Sulphate of copper dissolves rather slowly, and it is best made into a solution before adding to the birds' drinking water. About four ounces of the crystals will dissolve in about a pint of water and make a saturate solution.

Tincture of aconite, which is a very violent poison. and so rather dangerous to use, is a splendid febricite and cold cure, if given with care. Four drops to each pint of drinking-water is about the right strength. Aconite will nearly always cure severe colds that have not responded well to sulphate of copper treatment, and birds do not object to it in the water.

It is well to remember that fowls don't develop colds or other ailments without some cause. This cause must be sought out and removed. If birds catch colds and investigation shows that they are being kept on wet litter, this may be presumed, in the absence of other indications, to be the cause of the trouble. It will then be most important to clean out and supply fresh straw. Colds should never be neglected, as they spread rapidly and may later develop into some form of roup. which is a very serious disease.

## OTHER DISORDERS.

As I indicated when writing about foods and feeding, the excessive use of nitrogenous foods will set up liver diseases. Liver trouble usually results in the birds' combs becoming a dark purplish colour, and if this symptom is noticed, the mash should be suspected of containing too much protein.

Where any number of fowls are kept, occasional cases of crop-binding, prolapsus of the oviduct, dropsy, broken legs, etc., will be met with. None of these troubles is infectious, though each usually requires long treatment, and it is often more profitable to kill off the sufferer than to waste time in attempting a cure.

Sulphate of Copper and Tincture of Aconite are about the only medicines I give my birds. Very occasionally I give a sick fowl a dose of castor oil, but I have had a bottle of this medicine for the last five years, and, so far, have only used about a quarter of it.

Fowls that are well and carefully looked after need very little medicine, and should require no physicing for months on end. Apart from slight colds, which are soon checked, a well managed poultry-farm should keep free from infectious complaints, and as there are plenty of books dealing fully with poultry diseases published quite cheaply, I shall not discuss this subject further.

## PARASITES.

Fowls are often attacked by such insect pests as fleas and red mites. A careful watch should be kept for these parasites. Red mites are particularly difficult to get rid of, and very hurtful to the birds. As a precaution against parasites and disease germs, all houses should be very thoroughly disinfected when cleaned out, and frequently sprayed with a good germicide. Perches should be examined often, as they are a favourite lodging place of red mites and other pests. Dipping the ends of the perches and painting the sockets with creosote helps to keep red mites from the roosting birds. A little disinfectant powder should be kept in all nest boxes, as, if neglected, they will become infested with fleas. Naturally hens that are continually attacked by parasites cannot lay as well as they would do if unmolested, and a continual war should be waged against all such pests. The interior walls of all poultry-houses should be sprayed with a disinfectant at least once a month.

## FOWLS' DROPPINGS A VALUABLE MANURE.

Although there is not a very ready sale for this class of manure, the droppings from the fowls form a valuable plant food. If a market can be found for it it should add considerably to the profits of the business, and it will well repay any trouble taken in preparing it for use.

In its fresh state, poultry manure contains some 3 % of phosphate of lime, about 2 % of ammonia, and about ·4 % of potash, and is therefore some four or five times more valuable than farmyard manure. If thoroughly dried, it would be twice as valuable as in the fresh state. It has been estimated that each adult fowl drops under the perches some half-cwt. of fresh manure each year. In addition to this, probably nearly as much again is distributed about the land on which they range.

I recently heard of an excellent way of storing poultry-manure, which is used by a friend who, in addition to being a big poultry-farmer, has also a large general farm. The manure is all stored in a clamp as it is collected from the houses, and is then thatched in, in exactly the same way as a mangold or potato clamp, and it is thus protected from the rain, and loses none of its value. The manure remains in the clamp until the following year, when it has matured, and is then used in much the same way as an artificial manure, mainly, I think, upon the root crops. If thoroughly dried and powdered, poultry-manure would have a manurial value of something like five shillings per cwt., and some twenty-five cwt. of this powdered manure can be prepared from the droppings collected from under the perches from a flock of one hundred birds in one year. Each fowl, then, should therefore produce 1s. 3d. worth of manure each year, and this leaves out of consideration that distributed about the farm by the birds. Unless the manure is properly stored and put to good use when matured, much of its value will be lost, as, being in a soluble form, the valuable ingredients are soon washed out, if it is kept in the open and exposed to the rain.

The value of poultry manure is greatly increased by the addition of potash and phosphoric acid, in both of which plant foods it is rather deficient, and more especially in potash.

If used in the fresh state, the fowl droppings are difficult to spread, as being moist and somewhat sticky they are very liable to become lumpy; they are much more evenly distributed if first mixed with ashes or dry soil. It is a manure which should be used with a little care, as it can quite easily be applied too heavily, in which case it will " burn up " the crop, or in the case of corn crops, produce length of straw at the expense of the grain.

## CHAPTER 5.

# *Calling the Layers by Handling and Observation.*

### THE VALUE OF OBSERVATION.

WHEN poultry are kept principally for the production of eggs for consumption, the whole flock of layers must give a good average egg yield, or flock average, if they are to prove profitable. The laying powers of birds, even when they are all bred from the same parents, vary very much, and on the best managed egg-farms some poor layers are produced. One of the secrets of high profits is the early detection of these unprofitable birds, and their removal from the flock. When trap-nesting is practised, it is a fairly easy matter to find " dud " layers. Unfortunately, trap-nesting is costly in labour, and for this reason hardly an economic proposition on a purely commercial poultry-farm. On farms of this description, then, other methods of " culling " have to be used, and it is here that observation plays such an important part in the successful management of the stock.

### SPOTTING THE " WASTERS."

Of course, it is not possible to make an exactly correct estimate of a hen's laying powers without the aid of trap-nests, but any poultry-keeper can soon learn to spot the real " wasters." The examination of a pullet or hen should be sufficient to tell the attendant whether or not the bird is in lay and any healthy bird that is out of lay when the rest of the flock are giving a good egg yield, can be very strongly suspected of being a poor layer. A hen that has been extremely prolific will sometimes temporarily exhaust itself and go off lay for a week or two, but such a bird would never be mistaken by an experienced poultryman for a low producer.

### THE HEAVY-LAYING TYPE.

The shape and build of a pullet are some indication of the bird's laying powers, and nearly all heavy layers of any breed will conform to a certain type, characteristic of high-fecund stock. The following points can be noted in the prolific egg producer: A small, fine-textured head, and a full, bright eye. The back is long and wide, and legs set rather wide apart. The body is deep and full behind, allowing ample room for the vital organs. The breast-bone is short, and it should be possible to place at least three—and often four or five—fingers between it and the pelvic bones. The pelvic bones should be fine and wide apart—the whole giving a wedge-shaped appearance.

### HOGAN'S HANDLING SYSTEM.

An American named Hogan invented a system of estimating the laying powers of pullets by means of handling and observation, and claimed by his method to be able to forecast with very considerable accuracy the number of eggs birds would produce under favourable conditions.

The general opinion is that Hogan claimed too much for his system of handling, but in a modified form it is now very widely used in grading laying birds into classes of good, bad and indifferent producers.

## UTILITY AND EXHIBITION STOCK.

Fowls in utility show classes have to be judged for type alone, and a study of the winning birds will greatly help the novice to become familiar with the characteristic appearance of the heavy layer. Exhibition stock is judged without regard for laying points, and two birds of the same breed, that have gained awards, one in each of these very distinct classes, are usually strikingly unlike. A comparison of two such different specimens helps to impress on the mind the typical points of the heavy layer. Exhibition birds so often have the blunt head, fleshy face, and small shrunken eyes which usually denotes a poor producer. They are much larger, coarser, and less active than utility fowls, and compare in appearance somewhat as the cart-horse does to the thoroughbred.

## WHEN TO APPLY THE HANDLING TEST.

The appearance of a hen or pullet varies very much according to whether or not the bird is laying, and the handling test cannot be properly applied to birds before they have commenced to produce or during the moulting period. Photographs in this book of a pullet taken a few weeks before, and again after she started laying, very clearly illustrate this difference. The picture of the, as yet, unproductive bird, shows a small pale comb and wattles, and a slim body, compact behind, which gives a rather leggy look to the pullet. The second picture, taken when the bird is in full lay, shows the body to have become much deeper and fuller behind, and the legs seem to be shorter. The wattles and comb are much larger, and are bright scarlet in colour.

When a hen ceases laying owing to the moult, or from some other cause, the comb and wattles shrivel up, and the bright scarlet fades from them. The full, soft abdomen shrinks and becomes harder, and the pelvic and tail bones close up.

The two pelvic bones are situated on either side of the vent, through which the eggs are expelled. When a bird is laying, there bones are wide apart (two or three fingers can be placed between them), but when the egg yield ceases, they contract, leaving a distance between them of less than one finger's width.

### A SIGN OF LAYING.

A full, bright red comb usually indicates that the hen or pullet is laying, but it is not quite infallible, as non-producers sometimes possess this and other signs usually peculiar to the egg layer. These impostors can, however, always be detected by the close set of the pelvic bones. If, on the examination of the hen, these bones are found to be less than the width of a finger apart, it is absolutely and finally certain that she is not laying.

### MEASURING "CAPACITY."

Birds in lay differ very much in their rate of production. Some hens will drop an egg almost every day during a laying spell, whilst others will produce only two or three eggs a week. Each time an egg is expelled the pelvic bones "gape," to allow it to pass, and, in a hen that has been laying rapidly and continuously, these bones may be expected to be found more widely separated than would be the case with a bird which, having produced fewer eggs, has less frequently stretched open these bones.

Minute differences in the distance separating the pelvic bones in various birds cannot be taken to denote an exactly corresponding difference in the laying powers of the fowls, but it is fairly safe to assume that birds in which the width apart is less than two fingers are not generally good layers. Really heavy producers usually have a width of over two, and sometimes more than three fingers.

The distance between the end of the keel, or breastbone, and the pelvic bones is another guide to laying capacity. A prolific layer must have well-developed digestive and egg-forming organs, and the extent of this development is judged from the depth and width of the body and the space separating the keel and pelvic bones.

As I have already written, these handling tests are only of value when carried out on the birds when they are well in their laying stride. Good and poor layers, before production commences, or when it has ceased for the time, show little difference in " finger capacity," as at such times the bones are always closed together.

## WHEN TO START CULLING.

Culling should commence almost from the moment that the pullets reach the laying houses. Any bird that is very slow and late in starting to lay might be discarded. As the pullets develop on coming into lay, the way in which they shape should be observed. An eye should be kept on those that seem of poor type ; they should be handled, and, if obviously lacking the points of a high producer, culled. It is never advisable to be too ready to condemn quite young layers, and it must be remembered that a bird that has only just started to lay cannot be expected to " handle " as well as one that has a large number of eggs to her credit.

As the birds get older culling becomes easier, and may be undertaken with more confidence, and carried out with greater rigour. It is a good plan to handle the whole flock about once a month, if time permits, picking out and disposing of the birds which this test indicates to be unprofitable. With a little practice, it is possible to pick out any " duds " on sight, though it is as well to give them a close examination before finally discarding them. Such a bird will have a short, narrow and shallow body, with a small hard abdomen, pelvic and keel bones close together, the head blunt, small eyes set in a fleshy and rather feathery face. The comb will be small, but may be fairly red. In yellow-legged breeds, the pigmentation will be good. The bird will be rather inactive and have a gawky appearance.

A beginner will naturally have no great confidence in the success of his culling, and at first it is a good plan to place birds suspected of being poor layers in a house by themselves for a short while. Thus isolated, the true merits of these " suspects " can be easily ascertained.

## THE EFFECT OF LAYING ON PLUMAGE AND PIGMATION.

Prolonged heavy laying has a very noticeable effect upon the plumage and pigmentation of fowls. When a pullet just starts to lay, her plumage is smooth, sleek and glossy, and except in breeds having white, black or flesh-coloured legs, the legs are bright yellow. If the bird continues to lay well, the yellow colour gradually fades from the legs and beak, until they are practically colourless. The feathers become dull and dry, and the plumage ruffled. This loss of pigmentation and the drying up of the feathers, which is always most noticeable in the summer and autumn months towards the close of the laying season, is one of the best proofs that the birds so affected have laid well. The fowls which stand out in the flock by reason of their superior plumage and rich-coloured legs, are those that have failed in egg production. These birds, which are in the pink of condition, and apparently laying, are usually among the last of the wasters to be detected. If handled, their pelvic bones will probably be found to be so close together as to form certain proof that they are unproductive.

### WHEN TO SELL THE SURPLUS HENS.

If culling is well done, all the unprofitable layers, as far as they can be detected by handling and observation, should have been weeded out before the end of the first laying season. It often happens, though, that the poultry-keeper is still left with more birds than he has room for, after making provision for the accommodation of the growing pullets. The surplus hens will have to be disposed of by the autumn. These birds are best got rid of gradually, as they cease laying, and before they are heavily in moult. It is decidedly unprofitable to keep stock through the unproductive period only to sell them as they are about to commence laying again. Birds in the moult are in low condition, and do not command good prices. Hens having ended their laying season very quickly fall into the moult. They must be discovered at once, on the first signs of the feathers dropping, if they are to be got rid of in time to prevent their either having to be kept until they get their new plumage, or sold at a loss as moulters.

## CHAPTER 6.

# *Artificial Lighting for Winter Eggs.*

EGGS fetch so much higher prices during the winter months of October to January than they do during the rest of the year, and are so much more profitable, that every poultry-keeper aims to produce as many winter eggs as possible. It costs little, if any, more to produce an egg in winter than it does in the spring or summer, though in the scarce period it is worth two or three times as much as one laid in the season of natural production, when eggs are plentiful everywhere. The percentage of a farm's output of winter eggs has a very important bearing on the profits of the business, and will make all the difference between just scraping along in the case of a poor winter yield, and fat dividends where the output is high during this period of scarcity.

The modern egg-farmer now breeds only from hens that have proved to be his best winter layers; feeds these birds on a diet carefully balanced to favour egg-production; houses them luxuriously in warm, light, dry and well-ventilated structures, and provides them with plenty of exercise. Yet there is ample room for improvement in the winter supply of eggs, and it would appear that if we are to look for any large and immediate increase in our winter output of eggs, progress must be made along new lines.

### HANDICAPS TO WINTER LAYING.

Let us see in what way conditions in winter are less favourable to egg-production than in the spring, and what we can do, that we do not already do, to improve these conditions.

1.—The weather is generally unfavourable in the winter months.

2.—The birds obtain far less insect food than in the spring.

3.—The days are shorter, and there is less time for the birds to exercise and obtain the nourishment in excess of bodily requirements, necessary for heavy laying.

The modern laying house provides the birds with the maximum protection from bad weather, and the inclusion of fish, meat, and other albuminous foods in the fowls' menu as far as possible takes the place of insect food, and little more can be done to overcome the natural handicaps, unless, indeed, we instal heating apparatus in our laying-houses in order to keep them at a more equal temperature. It is, however, very improbable that the results obtained from such an installation would justify the heavy outlay and running costs in a country where the winter is as mild as ours is, and such " coddling " would jeopardise the stamina of our flocks.

### ORIGIN AND THEORY OF ARTIFICIAL LIGHTING.

For some years egg-farmers in America have been lengthening the winter days for their hens, in order to encourage heavier winter laying, by artificially lighting their laying-houses at night. Although most British poultry-keepers have heard of the use of artificial light upon laying birds to increase the winter egg-yield, this new aid to more profitable egg-production has been very little exploited on this side of the Atlantic. When, in 1922, the writer decided to illuminate his laying houses in the long winter nights, he experienced great difficulty in obtaining reliable and conclusive information on the subject. Many weeks were spent in making inquiries, in examining the information gathered, and finally on experimental work on the farm, before the lighting plant to be installed was decided upon in detail.

There must be a great many poultry-keepers in this country who are considering the advisability of supplying light to their birds in winter, and who wish to discover the most suitable illuminant and the best way to use it; the capital outlay that will be necessary, and the results that may be expected. In this chapter, I propose to describe the plant installed on Red Comb Egg Farm and successfully used since the winter of 1922; how, when, and for how long the light was employed, its effect on the egg yield, and the arguments in favour of the methods employed.

When we consider that a hen can, normally, only convert into eggs food consumed in excess of the amount necessary to nourish her body and keep her in good health, we can more readily understand the scarcity of eggs in winter. More food is obviously required by a hen during the long and cold winter nights for heating and maintenance of her body, than is needed in the short and milder spring and summer nights; yet in the winter, when more food is required to leave an equal surplus to be turned into eggs, the hen has a much shorter day in which to consume it. Bearing this fact in mind, we can hardly be surprised at the lower winter production of our birds, and it will be seen that the arguments for lengthening the winter day for our hens, by illuminating their houses at night, are based on sound and logical reasoning.

## ITS EFFECT ON STAMINA AND EGG PRODUCTION.

There is a certain amount of prejudice against the use of artificial light on fowls, on the grounds that it has a tendency to force the birds and must have an adverse effect upon their stamina and render them unfit to breed from. Perhaps this may be the case to some extent where the lights are kept on in the laying houses for several hours each night: but when the lights are turned on for, at most, one hour midway through the night, to give the birds a " midnight lunch " as it is called in America, it is difficult to see how harm can result.

When the " midnight lunch " method of using the lights is employed, the birds lose very little of the long night's rest, which may be necessary to their complete revivification during this period of the year, and surely the extra food eaten by the birds under lights, if it is not of a forcing nature, cannot be hurtful. The birds are not forced to eat food they do not require, but given the opportunity to refill their crops, already much depleted by the preceding hours of darkness spent on the perches. Providing layers with the chance to consume food, over and above the amount required for maintenance of their bodies, that is necessary for egg production, cannot be described as " forcing."

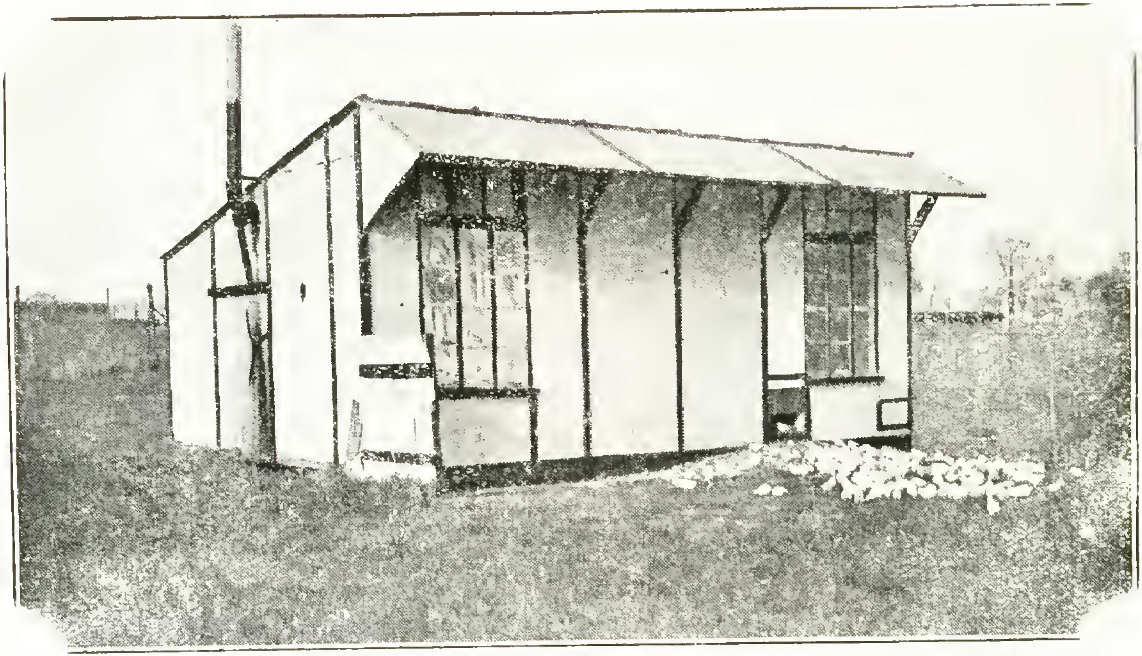
It has not yet been satisfactorily proved that any increase in the yearly egg average is obtained by the use of lights, as birds that have shown a great increase in winter egg-production, when given lights, have been noticed to lay less heavily in the early spring months than birds that have been comparatively unproductive during the winter. However, if we can get our layers to produce, say, an extra twenty eggs each during the period of high prices, we can afford to sacrifice a similar number of eggs at a time when they are plentiful and cheap.

## INSTALLING A LIGHTING PLANT.

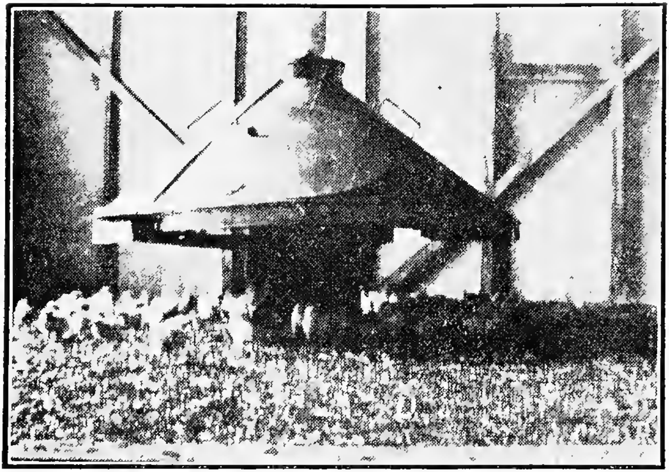
Electric light, petrol vapour gas, acetylene gas, and in some cases paraffin oil lamps, have been used with success. Of these various illuminants, electric light is the most economical for large installations, or where current can be obtained direct from a lighting company. The labour involved where paraffin, petrol vapour, or acetylene gas lamps are used, is very much greater than with electric lamps, and there is much more risk from fire.

For the egg-farmer who wishes to light several hundreds (or more) of his birds, an electric light plant will prove the best, as such an installation calls for very little extra labour, and the running costs are small. The majority of egg farms are situated where it is impossible to draw a supply of current from a company's main, and in such cases it will be necessary to put in a complete electric light generating set.

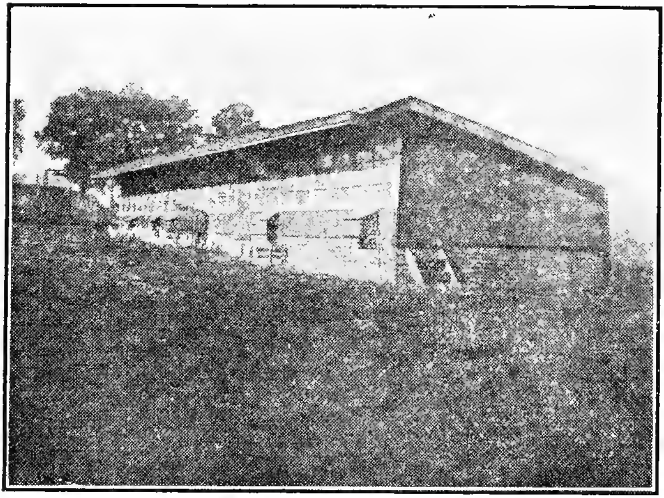
In order to decide on the voltage of the electric lighting set (which will be described) installed on Red Comb Egg Farm, answers had to be found to the following questions :—



ANTHRACITE HEATED BROODER HOUSE—CAPACITY 500 CHICKS.



ANTHRACITE STOVE FOR BROODING 500 CHICKS.



THE AUTHOR'S 60FT. FIRELESS BROODER HOUSE.

1.—How many birds are to be lighted?

2.—How many lamps, and of what candle-power, will be needed adequately to light such a number of birds?

3.—For how long, each night, are the lights to be on in the laying-houses?

4.—What amount of current will be consumed by lamps in the dwelling-house and outbuildings?

5.—What is the maximum current that will be required at any one time.

(1).—Although only about two-thirds of the laying-houses were to be fitted with lights in the first place, it was considered advisable to provide a set sufficiently powerful to allow for extension to all the remaining houses, giving a total accommodation for about 2,500 birds.

(2).—In order to determine the candle-power of the lamps, some experiments were necessary. Accordingly, a 50 volt dynamo was purchased, and a 60ft. laying-house, close to the dwelling-house, temporarily wired. This house was occupied by some old hens retained for the experiment, and the electric current to light the lamps was drawn direct from the dynamo, which was driven by a Handyman oil-engine, also used for pumping water.

It was found that one 30-watt gas-filled lamp (60 c.p.) provided with a white enamel reflector, was sufficient to light up each 20ft. by 14ft. section of the house. The interior of the house was whitewashed throughout and the lamps suspended centrally about four feet above the floor. A rather more evenly diffused light was obtained by using two 30 c.p. lamps placed ten feet apart; but to keep down installation costs it was decided to use only one 60 c.p. lamp to each section of the house, and this proved satisfactory. Lamps giving less than 60 c.p. for each 20ft. by 14ft. section proved insufficient. The birds were disinclined to leave the perches, and those that did so were unable to see the food properly, and appeared to be dazed and sluggish.

Apart from reasons of economy, it is unwise to use more powerful lamps than are absolutely necessary, as cases of total or partial blindness have been known to result from an over-brilliant illumination.

(3).—The usual methods of applying the lights are: To switch on as darkness approaches until eight or nine o'clock in the evening, or for a similar length of time preceding dawn, turning off the light when daylight arrives; or to light up for a short period of from half-an-hour to one hour during the night, say, between 10 and 11 o'clock.

Inquiries indicated that all these methods showed much the same increase in egg yield, and the third, or "midnight lunch" method has the great advantage of using much the least current; a most important point when electricity has to be generated on the farm. It was therefore decided to give the "midnight lunch," as this would need a much less powerful lighting set, and also because it was thought that birds under lights for not more than one hour each night would be less likely to feel any ill-effects that might possibly be associated with the use of artificial light than birds under its influence for several hours at a time.

(4).—Two lights burning for seven hours each day will use as much current as fourteen lamps of similar candle-power in use for only one hour daily, so that care should be exercised that no unnecessary lamps are kept burning in the dwelling house.

(5).—The lighting plant must be capable of keeping all the lamps in the laying houses, and a few in the dwelling-house alight simultaneously.

A 50 volt set with a 75 ampere hour battery was chosen as capable of supplying sufficient current to light any number up to twenty-eight 60 c.p. gas-filled lamps at once. This would allow for the lighting of twenty-six 20ft. by 14ft. sections of the laying houses and two rooms in the owner's house at the same time. A 75 ampere hour battery will store enough current to last two or three days without re-charging, when the twenty-six 60 c.p. lamps are used in the laying-houses for one hour daily, and two lamps of similar power are in use in the house for seven hours each day.

As a failure in the lights or any variation in the time or duration of the lighted period is likely to upset the birds to the detriment of the egg-yield, it was considered wise to employ storage batteries large enough to hold two or three days' supply of current, so that should the generating plant break down there would be an opportunity to carry out repairs before it was necessary to re-charge. The accumulators are always re-charged a day earlier than is absolutely necessary.

Current can be drawn direct from the dynamo and storage batteries dispensed with altogether; but this would probably prove false economy in view of the fact that slight dynamo trouble and the consequent failure of the lights would amost certainly upset the birds. Again, when lights are also required in the poultry-farmer's own house, the dynamo will have to be run for several hours each night just to keep one or two lights going, and the running cost will be a good deal heavier than where accumulators are included in the outfit. Nor will the light be so steady, as any variation in engine speed will cause " flickering."

Electric lighting sets of 25 volts are not well suited for use on any but the very smallest egg-farms, as where the light has to be carried any distance to the laying-houses, the pressure is too low to enable even a few lamps to give out their full candle-power. A 25-volt outfit installed on a farm where less than 500 birds were to be lighted proved an almost complete failure, owing to the impossibility of keeping the lamps illuminated at their full brilliance. Finally, this 25 volt plant had to be replaced by a more powerful 50 volt set.

## HOW TO USE THE LIGHTS.

The whole object of the " midnight lunch " is to get the birds to eat more than they would do without this extra meal, and, as soon as they have cleared up the food put down for them and have visited the water troughs, the light can be put out. Half-an-hour is ample for this purpose, and twenty-five minutes would probably suffice if the food were trough fed.

The food should never be buried in the litter, but placed where the birds can find it most easily. If troughs are not used, the litter should be scraped aside and the grain spread on the bare floor. Grain only should be given at the night feed, though the mash hoppers may be left open. Small maize, or coarsely kibbled large maize is perhaps the best corn to use, as it can very readily be seen and picked up by the birds. It is also a very warming and sustaining food.

The fowls will need a drink with their night meal, and, if the water vessels are not in the light, they must be moved to a place where the birds can see to drink.

Although the term " midnight lunch " implies that the night feed is given at midnight, in practice the lights are usually switched on about 10 o'clock, and, if half-past nine proved more convenient, I do not think the slightly earlier start would have a materially adverse effect upon the results obtained.

The night meal should consist of as much grain as the birds will eat—from half ounce to one ounce per bird. I give nearly an ounce a head, and if it is not all cleared up in the night the birds will eat it in the morning. I find that while the houses are being illuminated it is necessary to cut down the quantity of the morning corn feed, as the birds are not so eager and will neglect the mash if supplied with the usual morning ration of one ounce of grain each. Half-an-ounce per bird is about as much as they can manage.

When the birds are first subjected to artificial light, they are rather slow to come down to feed, so, to encourage them, the food should be put down after the light has been put on. In a few days they will learn that the switching on of the light means a meal, and will jump down immediately. From then on, the grain can be put down just after dusk, when the houses are closed for the night. This is the plan I adopt, and, as the lights are controlled from a switchboard in my house, there is no need to visit the laying sheds after they are shut up.

The date upon which the lights are first used in a laying house must depend upon the class of stock in occupation of the building. The benefit of the extra meal does not become apparent until the treatment has been in progress for two or three weeks; therefore early hatched pullets should be illuminated early in September before they have had time to lose condition. Late and backward pullets should also be lighted early in the season, as should hens not to be bred from. Breeding stock should not be placed under lights until well in the moult.

About the middle of February the use of artificial light can be discontinued, though if the weather is exceptionally bad it might be wise to carry on for another week or two. It is advisable to wean the fowls from the light gradually, taking about a fortnight in the process and reducing, by a little each night, the length of the lighted period and the amount of food given.

It is most important that once the lights have been started they should be given with great regularity and at the same time each night. Irregularities in time, or a few failures of the light will check egg-production, and in some cases bring on an untimely moult.

## DIMMING THE LIGHTS.

Every laying-house lighting installation should be fitted with a device for dimming the lamps. The dimming of the lamps serves two purposes. First, it obviates any strain which might be imposed on the birds' eyes were the lights suddenly turned on at full brilliance. Secondly, it provides a means of getting the birds back to the perches before they are left in complete darkness. There are two common ways of dimming electric lights. One, by imposing a sufficient resistance in the circuit to cut the illumination down to about half strength. The other, by cutting out a number of the storage batteries to achieve the same end. No electrician should have any difficulty in fixing up such an arrangement, which could easily be operated by a switch, and it should only add a small sum to the cost of the installation.

When dimmed, the lights should be just bright enough to enable the birds to find their way back to the perches, but insufficient for them to see to feed by. When the lamps are put on after dark, the dimmed light should first be switched on for about a minute before the houses are fully illuminated. At the expiration of the lighted period the lamps should again be dimmed for five to ten minutes, when the birds will gradually return to roost. After they have all taken to the perches, the current can be entirely turned off. Before the birds have become thoroughly used to artificial light, they will probably be rather slow in getting back to the perches when the light is cut down, but they soon get to learn that a dim light means that their meal time is over and are all back to roost within five minutes of this signal.

A dimming device could probably be dispensed with if the lamps were lit up in the early morning hours and left on until daylight, as there need be no danger from the sudden turning on of the lamps at full power if the bulbs are so hung and shaded that the rays from them do not strike direct upon the perches.

## THE BENEFITS AND COST OF WINTER LIGHTING.

The artificial lighting of laying houses must not be regarded as a means of obtaining phenomenal egg yields from birds that are already laying well : but as a practice which will aid birds that would otherwise produce poorly to yield a good supply of winter eggs.

We can depend upon well-bred pullets to lay heavily in the winter months if they are hatched at the right time, and, if all our birds answered to this description we should have little to gain by using lights. However, on the majority of egg farms, from half to two-thirds of the stock consists of hens and early and late-hatched pullets, and it is when used upon such birds that the night feed under lights proves so beneficial. Hens, particularly those of a light breed, are rarely good winter layers under ordinary conditions, and are very slow to come into production after the moult. Under the influence of the " midnight lunch," two and three-year-old birds improve in condition wonderfully, and I find my old birds now give a 25 % to 30 % egg yield in December, whereas I used to have to be content with 10 % to 15 %.

I have bred from hens when actually under the lights, the same birds having been also lighted in their pullet year, and the hatching and rearing results were quite as good (better, I think) as those obtained from unlighted stock. One has only to compare a flock of hens in a lighted house with a similar flock in a house without lights to be convinced that the birds gain both in health and vigour from the artificial lighting.

On a farm on which the laying houses are unprovided with lights, it is necessary to hatch all the pullets within a few weeks of a certain date to ensure a good winter egg yield ; but on a farm fitted with a lighting installation a much more extended hatching season is possible. The extra feed given during the nightly lighted period will help to prevent early-hatched birds from going into a pullet moult when eggs are most wanted, and keep them in lay until eggs are cheap. The treatment is also most helpful in getting late hatched pullets into lay earlier than usual.

The advantage to be gained from the winter lighting of the laying houses can be summed up as follows: An extra 12 to 15 winter eggs from the hens. Fitter breeding stock and a better supply of hatching eggs in the early part of the season. The avoidance of the pullet moult in early hatched birds and earlier eggs from late-hatched stock; giving a much longer rearing season without the usual sacrifices of winter eggs.

If hens and early and late-hatched pullets are placed in illuminated houses they should show an average increase in winter egg yield of at least 15 eggs per bird. The light does not appear to increase the yearly egg average and the winter gain in numbers is lost in the spring; but, as winter-produced eggs are worth quite twopence each more than those laid in spring, the gross gain from each lighted bird is 2/6 for the season. Against this has to be set the cost of the light and the value of the extra food consumed by the birds under its influence. I have not gone carefully into the cost of lighting my houses, but it is very little, and I think twopence a bird for the whole lighted period is about the right figure. During the time they are receiving the extra night feed under lights, each bird consumes about three to four additional ounces of food a week—at the most sixpennyworth during the whole period of about twenty weeks. A gross profit of 2/6 per bird, less eightpence expenses, leaves a net gain of 1/10 upon each bird under lights.

## CHAPTER 7.

# *Selecting Breeding Stock.*

THE wise and careful selection of breeding stock is of utmost importance, and the future success of the poultry will depend upon the skill with which the choice is made. Trap-nesting is the greatest aid in determining from which hens the next generation of layers is to be bred. However, the use of trap-nests is out of the question with the majority of farmers, owing to the very considerable labour which it involves, and the selection of the breeders will have to be based upon the handling and observation of the flock from which they are to be picked. These methods are relied upon on the majority of egg-farms, and in expert hands can be trusted to maintain a profitable flock average, and often to improve it.

### THE IMPORTANCE OF STAMINA.

So much has been written in poultry journals and books advocating breeding only from the heaviest layers, that many beginners are apt to lose sight of other important essentials in breeding stock, and select their birds purely on their trap-nest records, and without any regard to type or the all-important factor, stamina. Hens that are bred from should, of course, be good layers, but the most prolific layers are not necessarily the best birds from which to breed. Stamina is essential to the birds from which the future generation of layers is to be reared, and although very prolific egg-producers, must possess stamina to be able to lay so heavily, these birds are not always able to produce chicks of corresponding vitality. In fact, it is now thought that such birds use up so much of their vital forces by their phenomenal laying, that they are often unable to transmit the necessary energy to their offspring.

That there is something in this theory I proved many years ago, long before I came to Red Comb Egg Farm. At that time I kept, for a number of years, a small flock of White Wyandottes. The original birds were bred from two or three very heavy layers, and put up some remarkable egg records. Each succeeding year I mated up only a few of the hens with the greatest number of eggs to their credit, and continued to select my breeding stock on this principle for several seasons. Only a few dozen chicks were reared each year, and so broody hens were used, and I do not remember having any difficulty with the rearing; but, as season followed season, the eggs, which were always plentiful, became more and more imperfect and weird in shape, until, when the flock was finally parted with, there were as many badly-formed as good-shaped eggs being produced.

### TYPE.

On a farm run solely for production of commercial eggs, no very great attention need be given to this matter, and little points like the number of serrations on the bird's comb need not be considered. It is, however, important that breeding stock should be of good laying type, but this will follow naturally if the selection is made by handling and observation, as the birds that handle best are those that are nearest to the ideal laying type. Stamina and high fecundity should be the first consideration in picking the breeding flock, after which the utility show standard may be taken as a guide when making the final choice from birds about equal in other respects.

### WHEN TO SELECT BREEDERS.

When the culling methods, which I advocate in Chapter 5, are carried out thoroughly, most of the low-producers will have been eliminated by the autumn, and a very useful flock left from which to select the breeding stock. This choice should be made, as far as possible, before the moult sets in, and every bird should be carefully handled. Of course, at the end of a long period of laying, and shortly before moulting, the handler must expect to find the birds in rather poor condition; this particularly applies to the best layers, which will probably be very ragged in appearance, and inclined to be light in weight.

Any very small birds, and those with exceptionally small-boned legs, should be excluded from the breeding flock. Such birds may, quite probably, have laid extremely well, but are likely to produce progeny lacking in stamina. The tendency in strains very highly-bred for egg-production is for the birds to become smaller and smaller, and the chicks are often very hard to rear. A medium-sized bird should be aimed at, and very large, or very small birds should be avoided.

If housing accommodation permits, a larger number of birds should be selected in the autumn than will actually be required for breeding. They can then be given a last look over in the spring, before the incubation of their eggs commences. Also, the moult will often show up weakness in a bird that had not been previously suspected, and the extra number will allow for the removal of any birds that do not make a good recovery from the trying process of renewing their plumage. As a general rule, the best and most vigorous breeders are those that get through the moult quickly, and birds that feather slowly, and take a long time to get into laying condition again, should be thrown out of the breeding pens.

## WINTER LAYING.

Winter eggs being by far the most profitable, the winter-laying factor must be a necessary qualification for entry into the breeding flock. Trap-nest records are, of course, the best guide to winter-laying powers, but it is pretty safe to assume that the birds who prove to be the heaviest layers are also the best winter egg producers, and this is fortunate for those of us who do not practice trap-nesting. It is a good plan to put a distinguishing leg-band on those pullets which handling and observation during the winter months indicate as being the best winter producers.

## BREEDING FROM THE LATE MOULTERS.

Many poultry-keepers select their breeding stock from among the late moulters, reasoning that these birds have kept up their egg-production for the longest period, and so must be the most persistent, and probably the heaviest layers. This deduction is quite sound so long as it is applied to a flock of birds which have been hatched much about the same time. The periods when birds will moult is influenced by the date on which they were hatched, and when a flock of pullets have been hatched at various times, extending over several months, late moulting is a very poor guide in selecting the " cream " of the layers.

As an example, let us see how the choice of the last birds to moult, as breeders, would work out in my own case. My first hatch of White Leghorns usually comes off early in February, and is followed, at frequent intervals, by other hatches, until the end of April or the beginning of May, when incubation in discontinued. The early-hatched pullets will come on to lay the next summer, and will lay steadily until the late autumn. In October or November the majority of the earliest birds will drop into a pullet moult. The late-hatched ones will not commence to lay until September, October or November, and most of them will continue to produce eggs through the winter and the following spring and summer. The early pullets, which moulted at the end of the year, will start a fresh period of egg-production at a time when the later birds have already been laying for some months, and it is more than probable that they will lay later into the following year than their rivals, which laid throughout the previous autumn and winter. The most highly fecund of the early birds may not have a pullet moult, but they will be nearly certain to moult the next summer. In my case, then, if I selected my breeding stock from the latest moulters only, my choice would fall very largely upon the early-hatched pullets, and not the very best of them at that, and I should miss many extremely good birds belonging to the later hatches.

## INFLUENCE OF THE MALE BIRD.

The choice of the male birds with which to mate the breeding hens should be made with even greater care than the selection of the hens. A hen can only transmit her characteristics to chicks produced from her own eggs, but a cockerel will assert his influence on the birds raised from the eggs of the many hens with which he has mated. It is, therefore, of the utmost importance that cockerels used for breeding should have plenty of stamina, and should be from high fecund stock; in addition they should have no conspicuous faults of type. Although a cock cannot himself lay eggs, he is able, if he is a high fecund bird, to transmit the heavy-laying factor of his progeny.

The only definite proof that a male bird has the power of handing down the heavy-laying factor is to be found in the egg records of the pullets descended from him. Two cockerels, both offsprings of the same hen, may possess this power in very different degrees. In practise, we rely on the use of males descended from a long line of heavy layers, as a bird so bred is far more likely to possess high fecundity than the off-spring of an exceptional layer from a flock of poor strain.

Commercial egg-farmers commonly obtain their cockerels from pedigree breeders who have trap-nested their stock for generations back, and can give the egg record of every hen used in their breeding pens. Such birds are naturally more expensive than stock lacking a pedigree, but the male is of so great importance in the breeding flock that the extra outlay is more than justified. The cheapest form in which to purchase cockerels is as eggs or day-old chicks.

## MATURITY.

Birds, either male or female, should never be bred from until they have fully matured. Cockerels should be at least nine or ten mouths old before they are used for this purpose. It is not considered advisable by many experienced poultry-farmers to breed continually from pullets, though in my opinion, birds hatched in the very early part of the season make excellent breeding stock. I should advise those building up a new farm, to use such birds from which to raise their pullets the second year after starting, and so save the cost of purchasing hatching-eggs or day-old chicks. I doubt if rearing from early-hatched pullets, even when continually practised, would have any harmful effect on the stamina of the strain, though it is on the whole advantageous to use second-season birds as breeders, as this allows for the birds to be kept under observation throughout their first year of laying, and so there is less likelihood of poor layers or birds with any weakness finding their place amongst the breeding flock. Well-matured cockerels usually make better breeders than cocks, as they are more vigorous, and give greater fertility.

## NUMBER OF COCKERELS.

On a commercial egg farm, the breeding stock are almost invariably housed together in one or two large flocks. Fertility in these large flocks is generally high It should never be less than 90 per cent., and often exceeds 95 per cent. This is no doubt due to the fact that, in a flock where a number of male birds are used, should one cock or cockerel prove ineffective, the eggs which would be infertile if this " dud " bird was the only male in the pen, would be fertilised by his rivals.

In a light breed, such as White Leghorns, five cockerels to each hundred hens will be quite sufficient to insure good fertility; in a heavy breed, eight to ten males should be mated with one hundred females. There is no point in using a higher proportion of cockerels than that just mentioned, and it is a mistake to think that the more males in the breeding flock the higher will be the fertility. The opposite will often be the case, mainly owing to the rivals driving each other away from the hens instead of settling down.

It is never advisable to mate two male birds only to a small flock of hens, as one bird will probably drive the weaker of the two away, with the result that the fertility will suffer. For instance, three cockerels should be run with a pen of forty White Leghorn hens rather than two, which in point of numbers would be sufficient to give good fertility.

## CHAPTER 8.

## *Hatching and Rearing the Pullets.*

AT least half of the laying stock of an egg farm should consist of pullets, and it is a wise plan to aim at replacing each year some two-thirds of the layers with young birds. I have never yet heard a poultry-keeper complain that he had reared too many pullets and was out of pocket in consequence. On the other hand, I have heard many bemoan that they had not reared the pullets that they had expected to. In planning out a rearing season then, it is best not to be too optimistic, and to start in good time, so as to allow plenty of chance to make up for any reverses that may be met with from the earlier hatches.

On a large farm where hundreds of chicks are hatched out each year, some set-backs must be expected. Fertility may prove below expectations, a bad hatch may be experienced, or something may go wrong with a brooder. Again, rats, stoats, hawks, and other vermin may take toll of the youngsters. In fact, there is nearly always something to upset the calculations of the over-optimistic poultryman.

Many novices start their hatching campaign with the impression that they have only to incubate one hundred eggs to secure from forty to fifty pullets. In one or two cases in a hundred these estimates might prove correct, but on large farms, where many hatches are needed to raise the desired number of pullets, such successful rearing would be extremely remarkable, and I would doubt the sincerity of any poultry-keeper who claimed to get such results on a commercial egg farm.

## NUMBER OF EGGS NEEDED TO PRODUCE A PULLET.

The majority of egg farmers calculate the number of eggs to be hatched on the basis of one good pullet reared to laying age from every four to five eggs. I do not consider it safe to rely on getting the pullets required from a less liberal allowance of eggs. Surplus pullets can always be disposed of at a profit, but if the number of birds raised falls short of the earlier expectations, the flock can only be made up by purchasing grown or partly-reared stock, which is generally too expensive a method to prove economically sound on a commercial farm.

Many poultry-farmers are extremely reticent upon the subject of their rearing losses, and when discussing the matter, usually give a very optimistic, not to say misleading, account of the number of eggs hatched to obtain the pullets they have raised. My own opinion, gathered from personal experience, and that of others, is, that when several hundred pullets are reared each year, it may be considered fairly satisfactory to bring up twenty to twenty-five really good layers from each 100 eggs set. I know of a number of cases, mainly among beginners it is true, where rearing has fallen much below this standard, and of course much better results are quite often obtained.

On my own farm at Hermitage, I estimate the number of eggs to be incubated for my own use as follows: My incubator is a mammoth machine, and most reliable, and I can depend upon getting an average of seventy chicks from every 100 eggs set throughout the season. I find results vary very little from year to year, and can almost "count my chicks before they are hatched." From each seventy chicks hatched, I reckon to lose, from a variety of causes, ten to fifteen youngsters. Alas! my expectations in this respect are too often realised. Of the fifty-five to sixty chicks remaining, half will probably be cockerels, and one or two of the pullets may not be considered good enough to be kept in the flock.

Many readers will probably be appalled by the prospect of losing ten to fifteen chicks from every seventy hatched, but I am convinced that, on large farms, where chicks are run in large flocks to save labour, such a mortality is quite general. It is really a question of the survival of the fittest. Among a flock of 500 youngsters, the weaker ones will not thrive, and are best killed off at once if they fail to progress with the others. I am a strong believer in heavily culling chicks, and commence to do so even before they leave the incubator. Stamina is an all-important factor in a flock of layers, and we can only afford to raise the strongest of the chicks. Most of the chick mortality occurs in the first few weeks, up to which time the expense of keeping the birds has been very small, and the loss adds no more than a few pence to the cost to be borne by each of the remaining pullets. If the chicks were reared in quite small flocks in order that they could get more individual attention, it should be possible to keep the mortality appreciably lower, but this would add tremendously to the labour of rearing, and I doubt very much if the larger proportion of chicks raised would pay for the increased wages bill.

The rearing of chicks on a wholesale scale is a comparatively new thing in this country, and we are gradually improving our methods, and there is every probability that we shall in time master many of our present difficulties in connection with rearing in large flocks, and so reduce losses to not more than ten per cent.

I want to drive right home to the reader's mind that the chief troubles he is likely to meet with from his poultry will be in connection with the replacement of his old hens with pullets. The rearing season is always an anxious time, and it is important to start hatching early, to allow ample margin for making up for any unexpectedly heavy losses that may be met with. The final raising of the full number of pullets needed for replacement is the key to successful egg-production, and, if this is accomplished, even though losses have been heavy, there will be every prospect of a handsome profit from the business.

## CHAPTER 9.

# *Incubators and Incubation.*

THE successful hatching of eggs depends mainly on the following points:—

1. Fertile and hatchable eggs.
2. The maintenance of the eggs at the correct temperature during the twenty-one days necessary to incubate them.
3. Correct ventilation.
4. The right degree of humidity.
5. The turning of eggs.

The fertility and hatchability of the eggs will depend upon the breeding stock and their management, and neither the most reliable broody hen, nor the best designed incubator can possibly produce a good hatch from eggs of which a large proportion are unfertile, or in which the germs are weak.

Provided there be suitable conditions, a broody will look after the temperature, ventilation, humidity, and also turn the eggs, and so relieve the attendant of any anxiety on these points.

Although commercial egg-farmers have very little use for sitting hens, it may occasionally be advisable to use broodies to hatch a sitting or two of special eggs, for which it is not worth while starting up an incubator, so I will give a few brief hints on hen hatching before passing on to artificial incubation.

## HINTS ON HEN HATCHING.

Broodies should be given a well-made and hollow nest of hay, placed on top of earth, and protected by a weatherproof coop. The coop must be big enough to allow the hen plenty of room to stand up and turn round. It should be placed in a quiet and secluded spot, where the sitting bird will be undisturbed, and should be kept darkened. The best way to make a nest is to form the walls of a thick rope of hay and place a layer or carpet of the same material over these circular walls, to make a floor to the nest. Should the nest become fouled, it is a simple matter to remove and replace the " carpet " without disturbing the rest of the nest.

A hen is best placed on the eggs a few days after she becomes broody. If given charge too soon she may not settle down when put in the sitting coop, or if she has been broody already two or three weeks, may lose the desire to sit before she has brought off the hatch. Before setting a hen, she should be well dusted under the feathers with a disinfectant powder to protect her from insects, which would make her restless, and cause her to cover the eggs badly.

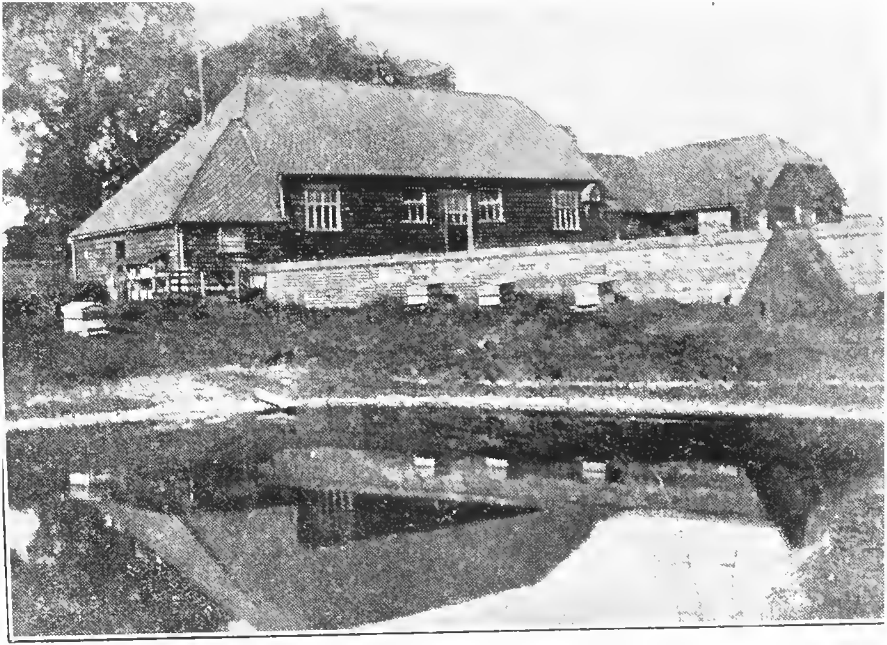
Sitting hens should be fed and exercised at the same time every day, and if two or more are released at once they should be kept apart, or they will probably fight. When several broodies are being fed at one time, it is a good plan to tether each bird to a separate stake by a few feet of string attached to one leg. Sitters should be fed on grain only, preferably maize or wheat.

Enough of so-called " natural methods of hatching," which are rather out of place and impracticable on our unnatural, but highly efficient modern egg-farms. It is well to remember that the present day heavy-laying domestic fowls are the direct result of Man's interference of Nature's work, and, from the point of view of profits they are immeasurably ahead of anything in the poultry line that Nature has yet produced unaided.

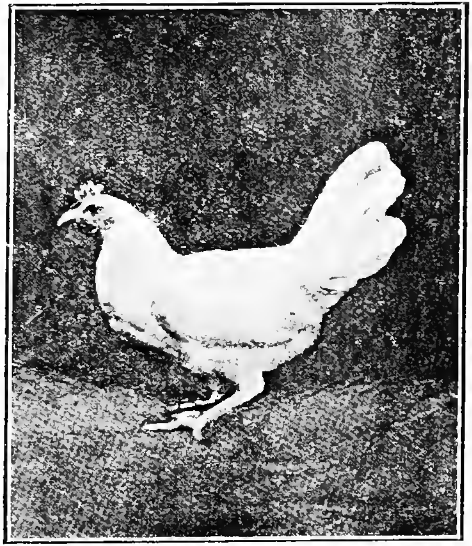
### INCUBATOR CAPACITY.

Before purchasing an incubator, or incubators, one has to decide what egg capacity is necessary to hatch sufficient chicks from which to raise the required number of pullets. Provision must be made for incubating, at one time, at least as many eggs as pullets are to be reared during the season. Twice this incubator capacity might well be used. As an example of how this would work out, I will take the case of a farm with a permanent stock of 500 layers, of which 300 are replaced each season. With incubators hatching a total of 300 eggs, four hatches would be needed to produce sufficient pullets. If the first lot of chicks came off in the first week of February, and the following hatches were commenced as soon as possible after the machines became vacant, the final hatch could not be completed before the middle of April. If some misfortune made it necessary again to re-fill the incubators, the resulting chicks would not hatch until well into May, which is on the late side even for light breeds.

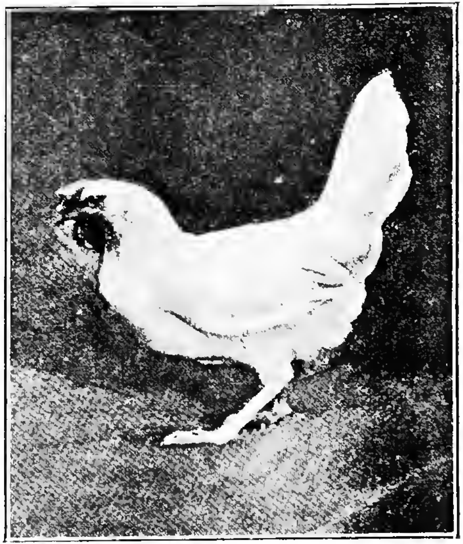
With sufficient incubator accommodation to hatch 600 eggs at once, two hatches should be enough. It is an undoubted advantage to bring out all the chicks within a few weeks of the same date, as this makes it possible to get most of the pullets into lay at the best time for winter egg production, and also shortens the rearing season. However, it is as well not to lose sight of the fact that a short rearing season necessitates not only greater incubator capacity, but also a corresponding



THE AUTHOR'S INCUBATOR HOUSE.



LEGHORN PULLET NEARING LAYING AGE.



LEGHORN PULLET IN FULL LAY.

increase in brooding accommodation. I will not attempt to lay down any hard-and-fast rule as to the exact size and number of incubators most suited to a poultry-farm of a certain size, as this is a point which any poultry-keeper can best decide for himself in view of his particular circumstances; but an incubator capacity of one hundred eggs for each hundred pullets required seems to be the irreducible minimum.

## TYPES OF INCUBATORS.

Incubators can be divided into two classes: (1) machines heated by hot water; (2) machines heated by hot air. Hot air incubators are much the cheaper of the two types of mechines, and are very popular indeed. The hot water incubators are probably the more reliable of the two and do not require quite so much skill in management. They are less liable to fluctuation in temperature, and very rarely fail to supply the necessary humidity, as is the case in some hot air incubators. There is really not a great deal of difference between the best machines of either class, and it is a debatable point whether the slight advantages of the tank incubators are worth the extra price usually charged for them.

## THE TEST OF GOOD INCUBATION.

The real test of an incubator's efficiency is not the percentage of chicks it hatches, but the number of rearable chicks it produces. Very often an incubator that has been run at too high a temperature, and with insufficient moisture, will hatch a good percentage of the eggs, the chicks from which will nearly all die off within the first week or two. If some of these dead youngsters are opened, they will probably be found to contain a hard, dry and crumbly yolk. When hatched, all chicks are provided with a yolk-sac and yolk, which should be gradually absorbed by the bird and which is sufficient to keep it alive for some days without any other food. When the egg has been too much "dried out" in hatching, this yolk becomes hard and indigestible, and is not absorbed as it should be. The non-absorption of the yolk compacts the bowels, and prevents the proper digestion of other food. The yolk soon commences to decompose, sets up internal inflammation, and the chick dies.

It is not possible to lay down any hard and fast rules concerning temperature, ventilation, humidity, and the turning and cooling of the eggs, as these factors will depend largely on the particular incubators in use, and the construction and situation of the incubator house, and also upon the climatic conditions. The best plan is to adhere closely to the instructions which are issued with each machine by the makers, and in whose interests it is that their incubators should give the best possible service to their customers. If it is found that a machine, owing to outside influences, does not give satisfaction when operated according to the instructions issued with it, then some modifications can be introduced. For instance, an incubator that had been giving good hatches when placed in a cool, damp cellar would probably give inferior results if removed to a much drier and warmer room, unless considerably more moisture was provided.

## TEMPERATURE.

The temperature which an incubator thermometer should show depends upon the position which the thermometer occupies in the machine and its distance from the eggs. Generally, the thermometer, if suspended about a quarter of an inch above the eggs, should show a reading of from 103 to 104 degrees Fahrenheit. If an incubator is started at 103 degrees Fahrenheit, and the regulation unchanged throughout the hatch, the temperature will gradually rise as incubation proceeds, owing to the heat generated by the growing embryos. In practice, it is generally necessary to adjust the temperature regulators during the course of the hatch to make allowance for the increasing heat given out by the eggs. I run my hot-water Mammoth machines at 103 degrees Fahrenheit (or slightly less) for the first week, 103 to 103½ degrees Fahrenheit the second week, and for the last seven days 103½ to 104 degrees Fahrenheit.

Though highly desirable, an exact and unvarying temperature is not absolutely vital to the hatching of the eggs. Many cases are on record of eggs being allowed to get practically cold during incubation, from accidental causes, in spite of which they have hatched fairly well. Again, one poultry-keeper may run at a temperature of 103 degrees Fahrenheit, while another gets equally good results from a machine of the same make by maintaining a thermometer reading of 104 degrees Fahrenheit.

### VENTILATION AND HUMIDITY.

All incubators are provided with automatic regulators operated by an ether-filled capsule (or thermostatic bar). These regulators not only control temperature, but to some extent ventilation and humidity also. If too much applied heat is let off by keeping the damper of the capsule regulator lifted excessively, the result will be too great a circulation of air and probably insufficient moisture.

Most machines are fitted with a water tray, over which incoming air is drawn, and from which it picks up moisture in its passage. The chief weakness with so many hot-air incubators seem to me to be that, though they tend to evaporate the eggs more than the hot-water machines, they are often less well provided with moisture-supplying fittings. An excess of moisture is also a possible but not a very common fault.

### TURNING THE EGGS.

Eggs should be turned during incubation to prevent the embryo sticking to the shell, and to ensure an even heat throughout the egg. Opinions differ as to how frequently turning should be done, but twice a day seems desirable. My Mammoth is provided with an apparatus with which all the eggs can be turned in about one minute, and as it is so little trouble I turn my eggs three times a day. I did try turning four times daily, but dropped it as it had no noticeable effect on the hatching.

### COOLING.

It is a common practice to cool incubating eggs after the first week. The egg drawer is usually removed for ten minutes each day, and often for a longer time towards the end of the hatch. Cooling should never be done after the eighteenth day. I have given up cooling my eggs and get just as good hatches as when I did so. I very much doubt if the actual cooling of the eggs is beneficial, though it may not be harmful. In a badly-ventilated machine, cooling probably gives the eggs a much-needed airing, and this possibly explains the improved hatches which this operation sometimes produces. I should advise beginners to consult the makers of their machine, or machines, before disregarding the instructions given as to cooling. Cooling does not appear necessary with my own incubator, but may quite well be advisable with others.

## NURSERY TRAYS.

Before concluding my remarks on incubation, I should like to call attention to what I believe to be the cause of much unnecessary chick mortality. Many incubators are supplied with nursery trays immediately underneath the egg trays. A slot is provided in the front of the egg tray through which the newly-hatched chicks fall to the tray beneath, when, attracted by the light, they come forward towards the glass window. This sudden change to the nursery tray, where the temperature is usually 15 degrees Fahrenheit to 20 degrees Fahrenheit less than in the tray above, is quite sufficient to chill the chicks, some of which may fall down before they are dry. Chilling is one of the commonest causes of chick mortality, and the rearer has very little chance of success with a batch that has suffered damage before they leave the incubator. The harm which I am convinced chicks often sustain through chilling in the nursery tray is often overlooked, because its ill-effects do not become apparent in the chicks until several days later, when the trouble is often put down to some other cause.

I never allow my chicks to drop into the nursery tray whilst the hatch is going on. When all the chicks have had time to emerge from the shell, I transfer them as quickly as possible to the tray below, and remove the egg drawer. When sufficient chicks are together in the nursery, they will keep each other warm, and when the egg tray is removed there is nothing to deflect the heat from them. (Some poultry-farmers prefer to take the chicks straight from the egg tray to the brooder, and never use the nursery compartment of their incubator.) One has only to hear the unhappy chirping of the little chicks as they drop to the nursery tray to realise that something is amiss, and it is then, undoubtedly, that much damage is often done that is wrongly laid to the blame of the brooder.

### THERMOMETER REGISTERING ERRATICALLY.

There is just one other little point in incubation which sometimes puzzles the beginner. If the thermometer is consulted when the hatch is taking place, it will often indicate alarming fluctuations in temperature. At such a time it is best to take no notice of the thermometer, as a wet chick touching the bulb will cause a low reading, whilst a dry bird similarly placed will give the impression that the machine is over-heated.

### STORING HATCHING EGGS.

A considerable difference of opinion exists as to the best method of storing eggs for incubation. Some poultrymen place the eggs on their side and turn them daily; others prefer to keep them vertical, with the small end pointing downwards. I always pack my hatching eggs awaiting incubation, point down in egg boxes. These cases of eggs I keep in my incubator room, and they remain undisturbed until they are unpacked and the eggs placed in the incubator. I have kept eggs as long as three weeks in this way, and found them hatch fairly well.

As a rule, eggs hatch best in an incubator if they are not more than a few days old when placed in the machine, but if I were hard pressed to make up numbers, I should not hesitate to use any I had on hand that had been laid two or three weeks. After all, a hen that "steals her nest" often brings off a 100 per cent. hatch, and at least a fortnight must elapse between the time she lays the first egg of the clutch and when she starts to sit on the complete sitting.

## THE INCUBATOR ROOM.

A good incubator room is one in which the temperature is not subject to large and sudden fluctuations. For this reason, a brick building is better than a wooden one, unless the latter has been specially insulated. My own incubator house is built of wood and beaver board, inside a large wooden barn, and proves quite satisfactory, though the insulation is far from perfect. The ventilation of the incubator room must not be overlooked, especially when a large number of oil-heated machines are in use. An atmosphere charged with oil fumes is anything but good for the chicks.

Incubators should be placed where there is no danger of their being shaken or jarred by banging doors or heavy traffic. Vibration of the machines may easily damage the embryo and prevent the chicks hatching out.

## CHAPTER 10.

# *Small and Large Brooder Units.*

BROODERS to rear flocks of about 500 chicks in single units are very much used on the larger commercial egg-farms; and although economical of labour, they are usually associated with a decidedly heavy chick mortality. In the last year or two there has been a tendency among egg-farmers to revert to the small unit system of rearing. I am inclined to think that this is a mistake, bearing in mind that much of the success of the modern egg-farm is largely due to low labour costs. These economies in labour have been effected by running all the stock in large flocks, and if we are to split up our chicks into a large number of small units, our wage bills will go up at once. The reason why mortality among chicks reared in small flocks is usually lighter than among large flocks is, I think, mainly because in the small units the birds receive more individual attention. It takes just as much time to feed and attend to a brood of 100 or less chicks as it does to look after 500 in a large brooder, and, unless they receive equal care and attention, the small flocks will not prove any more rearable than large numbers of youngsters brooded together.

The rearing of chicks in small units is admirably suited to the smaller farms requiring only two or three hundred pullets each year, but when practised on the large establisments, where thousands of chicks have to be raised in a season, it is a step in the wrong direction. It is a well-known fact that a flock of birds will give a better egg average if divided up into smaller pens than if housed together in one laying shed, provided, of course, that the feeding and management are the same in both cases, but most commercial egg-farmers will agree that it would not be an economic proposition to so split up their laying stock. The same ruling applies, though perhaps to a less extent, to the division of chicks. Small units mean much work, and if more eggs are obtained and a higher percentage of chicks reared as a result of their use than is the case with large units, it is extremely doubtful if these advantages are sufficient compensation for the increased labour charges.

As far back as I can remember, there has always been a margin for profit between the cost of feeding a flock of birds of good laying strain and the value of their eggs, and it was the excessive amount of work and consequent large wages bill which made the production of eggs for consumption a somewhat unprofitable venture on the old-fashioned poultry farm. It is only our simpler and more economical methods of management that enable us to answer the ever-recurring question "Does poultry-farming pay?" with an emphatic affirmative.

I do not think we can ever expect to rear chicks in large flocks with quite such small losses as in smaller lots, but I see no reason why we should not, in time, greatly improve on our present results with the large brooders. Appliances for brooding hundreds of chicks together were very little used before the war, and they are still very much in the experimental stage. Many of them had obvious and outstanding faults which are gradually being overcome. The earlier large flock brooders were, many of them, made solely with the idea of supplying the chicks with the necessary heat. Correct ventilation and humidity were very little considered, though almost as important as warmth. Several experienced poultry-farmers have now given their attention to the designing of brooders for use on the larger commercial farms, and I have strong hopes that their efforts, backed as they are by practical experience of chick-rearing problems, will result in the production of appliances that will brood large numbers of birds with much smaller losses than is the rule at present.

## SMALL UNIT BROODERS.

I will deal first with small unit brooders, as being the most suited to beginners whose chick-rearing operations will probably be conducted on too modest a scale, at first, to justify the installation of brooders with an individual capacity of some 500 chicks.

Appliances for brooding small flocks of chicks can be split up into three main classes:—

1.—Self-contained outdoor foster-mothers.
2.—Hovers for indoor use.
3.—Fireless brooders, which are used both indoors and outdoors.

### FOSTER-MOTHERS.

The outdoor foster-mother is one of the oldest types of brooder, and is very generally used by the smaller poultry-keepers. These rearing appliances are usually divided into two compartments—a " hot " room and a " cool " room. Sometimes a third compartment is provided, which is floorless, and forms a covered run for the chicks. Warmth is supplied by an oil lamp either placed straight in the hot chamber or used to heat a tank of water, or air carried through the chamber by flues.

One drawback to the outdoor foster-mother is that it is difficult to attend to the chicks in them satisfactorily during stormy weather. When the brooder has to be opened, in order to feed the birds or trim and regulate the lamp, wind and rain cannot be excluded, and may harm the chicks.

## INDOOR HOVERS.

Indoor hovers are usually placed separately in small colony houses, though a number of them are sometimes placed together in larger buildings, but divided off from each other. These hovers are extremely simple in design, and are heated by oil lamps. They are so designed that the chicks can, by approaching closer to or retiring from them, obtain the exact degree of warmth they require.

In my opinion, small colony houses, each supplied with a small hover, and used to brood about 100 chicks, are far superior from almost any point of view to the self-contained foster-mother. In bad weather, the attendant can get inside the colony house when feeding or otherwise superintending the chicks, and the youngsters have far more space to exercise in when confined to the brooder than they have in a foster-mother, which is always troublesome to manage in windy or rainy spells. The cost of a good indoor hover, together with a colony house, is about the same as that of a self-contained brooder, and whereas the latter appliance is useless after the chicks are about two months old, the small house can be used, with the hover removed, to shelter the pullets till they are drafted to the laying-house.

For small unit brooding I do not think the indoor hover can be surpassed either for rearing results, convenience, or economy in capital cost. The bulk of my own rearing is done in large flocks, but I have always found it necessary to have some accommodation for rearing the occasional small odd lot of youngsters that have to be dealt with from time to time, in a rather protracted rearing season. I used to keep one or two foster-mothers for this purpose, but found them a great bother to look after, and I have now discarded them in favour of indoor hovers. It is these indoor hovers that have replaced the large unit brooders on some of the large commercial farms, where thousands of chicks are reared each year.

These colony houses need not be provided with floors. To prevent rats or other vermin getting in to the chicks, the bottom of the houses should be covered with a fairly fine mesh wire netting. The netting should be then covered with an inch or so of fairly dry earth, upon which the litter should be placed. Straw chaff, cut short, is a good and inexpensive form of litter. These small houses can be moved about fairly easily, so that the young birds can always be on fresh, sweet land, without being moved into fresh quarters.

Colony houses for use with indoor hovers should be chosen with care. I well remember the first time I tried an indoor hover. It was in the early part of the season, and I used a rather large lean-to house, the top six inches of the front of which was open, save for wire-netting and a protecting hood. Do what I would, I could not prevent floor draughts, with the result that the chicks suffered heavy casualties, and for the time being I discarded the hover in disgust. Floor draughts are absolutely deadly, and it is impossible to rear chicks under these conditions. Since those days I have learnt not to use a house of which any part is permanently open. I prefer the span-roof type with a glazed window (or windows) that can be opened a varying amount; for bad weather the windows can be kept shut, and fresh air admitted through a ventilator in the apex at the end of the house. A house of this sort, 6ft. long and 4ft. wide, would be large enough to hold one hover and about one hundred chicks. The hover should be placed towards the far corner of the house, and if any floor draught is experienced, this can be countered by running a barrier of galvanized iron or wood partially round this corner. A protecting barrier is not generally necessary in a house such as I have described.

### FIRELESS BROODERS.

Fireless brooders have come into prominence during the last few years, and can be used both indoors and outdoors. They are cheap to run, as there is no lamp to burn oil, and, once the chicks have been comfortably settled for the night, they can safely be forgotten until the following morning. I have about twenty of these fireless rearers, each large enough to hold 70 or 80 chicks, placed in a long brooder house, but each divided off from the others. My chicks are transferred from my stove-heated houses to these brooders when they are about three weeks old. I find this a most satisfactory way of raising the youngsters from this age until they are six or eight weeks old, when they are moved to small colony houses.

I used to transfer the chicks direct from the coal-heated brooders to the colony houses, and then felt the need of some intermediate stage, as the birds were often inclined to crowd for the first week or so after leaving the heated brooders. Since I have used the cool brooders I have had no repetition of this trouble.

I have never tried to rear chicks from the day-old stage in fireless brooders, and I gather from what I have been told by poultry-farmers who have done this, that it does not prove an entirely satisfactory method of rearing chicks on a large scale from day-olds. Outdoor fireless brooders, I believe, give excellent results with chicks of any age, but require too much attention to be used when more than a small number of pullets are to be reared. When used indoors, these cool brooders do not seem so satisfactory for newly-hatched birds—it is probably a matter of ventilation.

When chicks of any age are first placed in fireless brooders, they will need a good deal of attention, as they will have to be taught to find their way in and out. They are sometimes rather slow to do this, as there is no lamp to attract them, and the boxes are somewhat dark inside. Once the youngsters have learnt to return to the brooder for warmth, they require very little attention ; less probably than in any other type of brooder.

## LARGE UNIT BROODERS.

Large unit brooders are nearly all heated either by hot water or by stoves burning coal or oil. I believe there are a few electrically-heated chicken-rearing appliances in existence, but as they must consume a lot of current, they are out of the question on most poultry-farms.

### BROODER STOVES.

As far as rearing results go, I do not think there is much difference between oil and coal-burning stoves. Of the two, I believe those using oil fuel are the most expensive to run, but they should be more easily regulated than anthracite stoves. which have a tendency to burn low in the early morning.

I have had very considerable experience with anthracite stoves, and still use them; they require a little understanding to get the best results from them. I have frequently heard novices say that they have been unable to keep these stoves alight. This should not be the case, and I have never experienced this trouble myself. In the first place, a good draught is absolutely necessary, and a rather high chimney should be fitted to ensure this. I find a stove requires cleaning at least once during the season, as the flues get choked after a couple of months' continual burning. All the anthracite brooder stoves of which I have had experience have given off a sulphurous deposit, which is sometimes a fine powder, and at other times a wet, sticky substance. In either form it will eventually clog the flues, and affect the burning of the stove unless removed from time to time. Anthracite coal, washed and hand-picked, and about the size of a chestnut, is the best fuel to use, though ovoids, coke, or soft coal will serve in an emergency.

I do not know of any brooder stove that is fitted with any device for counteracting the very dry heat that all these stoves give off, and particularly the coal-burning ones. This dry heat is the worst fault of the brooder stove, and I am surprised that the makers of these appliances have done nothing to overcome this trouble. Fortunately this omission can be fairly easily remedied by suspending troughs of water immediately underneath the hover. The speed at which water evaporates from these troughs shows how dry is the heat given off by the stoves. Standing pans of water in the corner of the brooder house does not supply sufficient moisture

## WATER-HEATED BROODERS.

It is probable that in time the hot-water system of brooding will supersede the brooder stove. Such a system is more economical to run, as a number of units can be heated from one stove. This saves coal, as well as time otherwise spent in tending several fires. There is, however, still room for improvement in most water-heated brooder systems. The heat is " gentle " and not dry, as with the stove, but the ventilation is often defective. A large number of chicks close huddled together soon exhaust the supply of oxygen unless there is a plentiful circulation of fresh air. In many of these appliances too much attention has been given to the conservation of heat, and a good circulation is impossible. The more often the air under the hover is changed, the more is heat lost. It is not an easy matter to provide adequate warmth and at the same time allow the liberal circulation of fresh air, which is so vitally necessary to the chicks.

I have seen three different patterns of hot water brooder tried, found wanting, and scrapped, on farms with which I have been in touch, and as these installations are costly, I do not advise anyone to invest in such a plant, or, for that matter, any type of brooder, until they have quite satisfied themselves that the appliance has given good results in actual practice. Warned by the experience of others of supposedly improved brooders. I still stick to my anthracite stoves; though I shall be quite willing to part with them when I am certain I have found something distinctly better.

I do not think that at present any of the well-tried water-heated systems are more successful in chick-rearing than the best of the anthracite stoves. I have never had a hot-water brooder on my farm, and so cannot write from personal experience, but I know many egg-farmers who use this method of rearing, and these men get much the same results as myself and others who use the stoves.

Water-heated brooders are certainly the easier of the two systems to operate, and the attendant can go to bed confident that the chicks will neither be chilled nor over-heated during the night, which is by no means the case when several brooder stoves are in use. If I was building up a new farm, these reasons might tempt me to install a hot-water brooding plant in preference to any other system; unless, capital outlay being an important consideration, I found that I could put in brooder stoves at considerably less cost.

To sum up, then, coal and oil-burning stoves, and hot-water brooders, all give much the same results. Anthracite stoves are probably cheaper to run than oil, but are perhaps a little more difficult to manage. Of the three, hot-water brooders are the simplest to manage, and the cheapest to run, but are generally the most expensive to install.

## CHAPTER 11.

# *Chicken Ailments.*

BEFORE dealing with the general management of chicks, I shall discuss some of the more common ailments and diseases to which the young birds are prone. With a knowledge of chick ailments and their probable cause, the reader will be better able to appreciate the importance of what might otherwise appear somewhat motiveless details in the care of the chicks.

### BACILLARY WHITE DIARRHŒA.

The disease to which more deaths are attributed than to any other cause is Bacillary White Diarrhœa. That many deaths are wrongly attributed to this "popular" disease, I have no doubt whatever. It is a peculiarity of chicks that, no matter what trouble they are suffering from, the symptoms in the vast majority of cases are almost identical, and usually take the form of some derangement of the digestive organs.

### NOT ALWAYS B.W.D.

It is always a sop to the pride of an unsuccessful chick-rearer to attribute losses to B.W.D., because chicks so afflicted are certain to suffer heavy casualties, no matter how carefully they are looked after by the attendant. Chilling or overheating of the chicks, particularly in the first few days, or even mistakes in incubation, may lead to very heavy casualties between the first and second week of the chicks' lives. Even when some error is made in the brooder the first day or two, the effect is rarely very noticeable on the chicks at that time, and they may appear perfectly healthy for the next few days. Within a week they will be dying off, and it is then too late to save them. In these circumstances, inexperienced poultry-keepers overlook the accidental cause of all the trouble, as the chicks do not appear to be any the worse at the time, and in order to explain the catastrophe they blame their heavy losses to B.W.D.

Some experienced poultry-keepers deny that there is, in fact, any such disease in existence as B.W.D. Though I do not share this opinion, I am inclined to think that far too much has been made of it. Scientists have discovered the germ (Bacterium pullorum) causing B.W.D., and claim to be able to detect carriers of the disease, but we still have much to learn about this terrible scourge.

### NO EFFECTIVE REMEDY.

During the last year or two, a good many poultry keepers have submitted their breeding stock to the blood test, and discarded any birds that reacted to the test, and whose chicks would be likely to suffer from the disease. One might expect that if B.W.D. is really the cause of anything like the number of heavy losses for which it is blamed, chicks bred from flocks which have been proved by blood test to be free from bacterium pullorum would prove very much more rearable. This is certainly not the case in every instance, as has been proved by the experience of one commercial egg-farmer with whom I am well acquainted. This man had his hens tested by a well-known expert, and, after throwing out any affected birds, bred from the remainder. At the end of the rearing season, he admitted to me that though he thought he had not suffered from B.W.D. that year, his rearing results had nevertheless been very little better than in previous seasons.

The presense of B.W.D. in a flock of fowls does not necessarily mean that the chicks bred from them will be impossible to rear. In fact, provided the brooding conditions are more or less ideal, the disease may remain dormant in the chicks. Apparently none the worse themselves, it is alleged that these birds will transmit the infection to their offspring.

If B.W.D. is as prevalent as it is said to be, I doubt very much if it will ever be possible to stamp it out. It is apparently extremely contagious, and it affects other classes of stock as well as fowls (wild birds, for instance). Even if all birds on a farm are given the blood test, and the carriers removed, there seems every possibility that the disease may be contracted again through the agency of some wild bird, in which we cannot control the disease.

It seems, therefore, that, as we have no guarantee that the birds once free from B.W.D. will remain so, any money spent on giving our birds the rather elaborate and costly blood test will be largely wasted, if further tests have to be made at frequent intervals to ensure a clean bill of health. It would probably be better to reconcile ouselves, at present, to an ill for which, as yet, we have no effective cure, and concentrate upon improving our brooding methods, so that in spite of the disease our chick rearing will be a success. B.W.D. seems to have no ill-effect whatever on adult birds, or birds after they are half-grown, and although flocks of layers may be thoroughly impregnated with the infection their profitableness is in no way affected. If, therefore, we can managed to rear our chicks when they have the disease, we can afford to ignore its existence altogether.

## SYMPTOMS AND TREATMENT.

Chicks suffering from white diarrhœa stand about with their wings drooped and their eyes closed, usually in the warmest part of the brooder. A whitish, gummy discharge can generally be noticed. The sick birds keep up a frequent loud and distressful chirping.

No treatment is very effective in a flock of chicks attacked by B.W.D. It is useless and unwise to try to cure chicks that are sick from this cause. They will probably die in any case, and even if they are saved there is serious danger that they will pass the complaint on to other youngsters that are still healthy. It is best to kill off the birds immediately they become affected, and to burn them. The brooder, water vessels, and feeding boards should be kept scrupulously clean and well disinfected, and it is a wise plan to add a little disinfectant to the drinking water.

## COCCIDIOSIS AND TUBERCULOSIS.

Coccidiosis is another disease often responsible for heavy losses. Unlike B.W.D., it may attack birds of all ages, as well as rabbits and ducks, which are particularly prone to it. Birds suffering from this disease become very light, and on post-mortem examination the liver and other intestines will be found covered with small white spots.

The symptoms of coccidiosis and tuberculosis are easily confused, as in both diseases the victim "goes light," and when the bird is opened for examination tubercular nodules in the organs are easily confounded with the whitish spores of coccidiosis. As with B.W.D., it is not advisable to attempt to cure birds suffering from either of these complaints. They should be destroyed and burned; and, to prevent other birds becoming infected, strict cleanliness should be observed.

## PNEUMONIA.

Pneumonia, though not infectious, may often carry off a considerable part of a flock of chicks. Until they are feathered, young birds are very sensitive to cold winds, and, if allowed to go straight from the hot compartment of the brooder into the run outside when the wind is in an easterly direction, many of them will probably contract pneumonia. This is not an ailment affecting young chicks only, but there is far more danger of this complaint during the first few weeks than at any other time during the birds' lives.

### AVOID EXPOSURE.

While fowls stand cold fairly well, they hate windy weather, and it is never advisable to expose chicks to this element until they are fairly well feathered. If chicks, while in the brooder-house stage, are caught out in a shower or get thoroughly wet in long moisture-laden grass, they will be likely to develop lung trouble.

Pneumonia is almost always fatal with young chicks, and they rarely survive more than twenty-four hours after contracting this complaint. The symptoms are easily distinguished, as the chicks usually lie stretched full length on the floor with their beaks wide open and their throats dilated, obviously fighting for breath.

### GAPE WORMS.

On farms where fowls have been kept for a great many years, chick-rearing is often made very difficult by the presence of gape-worms. These worms are picked up by the chicks on the ground in the form of spores. These spores develop in the chick's body into small thread-like worms, which attach themselves to the chick's throat and cause partial suffocation.

Chicks harbouring these worms are easily noticed. They are continually coughing and opening their beaks wide, and stretching out their necks (or in other words "gaping"). A very old treatment for this trouble was to thrust a feather down the throat of the afflicted bird. The feather was then given a slight twist and then withdrawn, when the worm would come with it. Although an effective treatment, this cannot conveniently be applied to a very large number of chicks.

Another good method of ridding the birds of this troublesome parasite is to enclose the youngsters to be treated in a nearly air-tight coop, into which a specially prepared powder is then puffed. This causes the birds to cough up the gape worms, which only attack youngsters in the first weeks of their lives.

There is very little danger to be feared from gapes on new land, and I have not seen any cases for years. But on taking over a holding, which is known to have been used for poultry-keeping for any considerable time, enquiries should be made to find out if the soil is infected with these worms, which will often lie dormant, as spores, for a year or two after all the fowls have been removed from the land.

## LEG WEAKNESS.

Leg weakness and toe-pecking are both troubles more often associated with the large unit system of brooding than with smaller flocks of chicks. Prolific causes of leg weakness are a lack of bone-forming material in the diet and of direct sunlight; continued over-heating; and keeping chicks on boarded floors. It is almost essential to equip large immovable brooding houses with boarded or concrete floors, as otherwise the earth would, in time, become so fouled as to be a danger to the birds. When the brooder floor is boarded it is advisable to make a double floor in the hot room, two layers of boards being laid at right angles. The heat from the brooder stove soon warps even inch-thick boards. Unless a double floor is used, the fissures which will result from this warping will admit currents of cold air, which will make it quite impossible to rear the chicks successfully. In this respect, concrete floors are an improvement, although there is some prejudice against them in certain quarters. I have found them quite satisfactory if they are tarred to prevent the damp coming through. Brooder floors should at all times be kept well covered with litter, and if this is done, the danger of leg weakness will be greatly minimised.

### THE HABIT OF TOE-PECKING.

Toe-pecking is a vice which is very rarely met with other than in large flocks of chicks. If unchecked in the early stages, it can become a very serious matter. I have know cases of extremely heavy losses from this cause in large unit brooder-houses. A number of reasons have been put forward at various times to account for outbreaks of this vicious habit, which, once started in a flock, spreads very rapidly. Deficiency of green food in the diet may be a contributory cause, but idleness in the chicks is most to blame for the trouble. If a large flock of youngsters are allowed to gorge themselves early in the day, they will have no incentive to search for more food, and will be inclined to hang about. Chicks are always attracted by bright objects, and if they have nothing better to do will peck at the tiny veins in another chick's foot, which show up very plainly in strong sunlight. Once the skin is broken, other chicks are attracted by the bright colour of the blood, and will, if not discovered in time, injure their victim irreparably. If this happens two or three times, the habit will become ingrained in many of the chicks, and great difficulty will be experienced in preventing a disastrous outbreak.

### PREVENTION.

The best preventive against toe-pecking is to colour the brooder-house windows blue. In the subdued blue light which results, the veins in the bird's feet are less noticeable. Chicks should be kept busy all day long, and it is not hard to do this if their food is given at frequent intervals, and always well buried in the litter. At the very first sign of toe-pecking, a watch should be kept for the offending bird, or birds, which, when detected, should either be destroyed or placed apart from other chicks. This habit is hardly ever met with once the youngsters have left the brooder houses. It is much more prevalent some years than others, and I only remember one season when I was seriously worried by this trouble, and that was the very hot, dry summer of 1921.

### ACCIDENTAL LOSSES.

It is most important to avoid dropping any screws or nails in the houses or runs occupied by the chicks, as if these bright objects are found by the birds they are almost certain to swallow them. In building a brooder, every nail should be accounted for, as every one that is left lying about will, in all probability, cost a chick its life.

Stoats, rats, hawks and magpies are all vermin which prey on young chicks, and unless a constant watch is kept for these pests, a very large number of chicks may be lost as a result of the depredation of these destructive creatures.

The old adage, " prevention is better than cure," is particularly applicable to all the troubles met with in chick rearing, as once the youngsters contract a disease or ailment, the chances of a cure are but slight.

Probably at least as many chicks are lost from wrong feeding and careless management as from any actual disease; and over-feeding during the first few days is a fruitful cause of the bowel trouble so often fatal in young birds.

## CHAPTER 12.

# *The Feeding and Management of Chickens.*

### PREPARING THE BROODER.

THE brooder heater should be started up a couple of days before the chicks hatch out, in order that a perfectly correct and even temperature can be obtained before they are placed in the brooder. When working with an unfamiliar type of brooder, it is just as well to allow a few extra days in which to experiment with the regulation of the stove, lamp, or other heater, as the case may be.

When first placed in the brooder, the chicks require a temperature of 90 deg, Fahr. As the chicks grow older, the temperature can gradually be reduced; but it is better to rely on observation of the chicks themselves as a guide to obtaining correct temperature than to abide by any definite rules governing the warmth said to be necessary to chicks of various ages.

A low ring of fine mesh wire-netting should be placed round, and about one foot away from the hover, when the chicks are first placed in the brooder. This will prevent the youngsters from wandering away from the warmth to which they may not be able to find their way back again. After the first day, the wire netting can be removed, as, by then, the chicks will know their way about.

The chicks do not require any food until forty-eight hours after they are hatched. I usually keep my chicks in the nursery of my incubator for one day, and transfer them to the brooder-houses late in the afternoon, as darkness is descending. I do this because I have found that if the light is very subdued, the youngsters are not tempted to stray out of place. Once they have come safely through the first night they will quickly become accustomed to their new quarters.

All brooder-houses should be supplied with dark blinds, without which it is impossible to get the chicks to settle down for the night before dark. These blinds should fit the windows closely, as if when drawn, they let through any beams of light, the chicks will all congregate and crowd together in any of those parts of the brooder floor upon which these light beams play. The chicks are always attracted by light, and a sunbeam striking the far corner of the brooder will attract many of the little ones away from the hover. Young chicks seem to associate light with warmth, and an ill-fitting blind to the brooder-house may easily be the cause of many of the chicks getting chilled.

I do not think it is wise to keep chicks in the brooder for a whole day before their first feed. If this is done, they are likely to get into mischief. They may develop the toe-pecking vice, or more probably still, eat the extremely indigestible litter in the absence of anything more palatable.

## THE FIRST FEED.

In the morning of the second day after hatching, the chicks should be given their first feed, and one of the best first foods is pin-head oatmeal. This is very readily digested, and taxes the internal organs of the youngsters less than dry chick food. When giving the first meal, I scrape away the litter from a good part of the floor, and sprinkle on the bared area a little of the oatmeal mixed with a very fine limestone grit. The chicks will soon see the food on the bare floor and commence to feed, and after the first couple of meals have been given in this way, it can be spread in the litter, as the birds will by then have learnt to scratch for it.

As soon as the chicks have commenced to pick up their first feed, I place a number of water-vessels about the brooder, where the birds can easily find them. The chill should be taken off the water, and one of the best ways to do this is to place a can of it in the hot chamber of the brooder overnight.

### TRAINING THE CHICKS.

The large unit brooders are usually made with two compartments, but some have only one. In a two-compartment brooder the chicks should be given food and water in the warm room during the first day of feeding. The following day they should be allowed to take their meals in the cool room, the communicating door having previously been left open in order to warm it up somewhat. It will take the chicks a little while to find their way back to the warm room, and at first they should be shepherded back after a feed and before they begin to feel cold. A careful watch must be kept for the first few days until the attendant is quite sure that all the chicks know their way back to the hover. It is just as well to remember that the sun's rays falling on the corner of the brooder may well cause the youngsters to collect in the sunlight even after they know their way back.

During the first two or three weeks the chicks should be fed at two-hour intervals throughout the day. Frequent feeding keeps them busy and active. The attendant should always aim at keeping the chicks on the hungry side, and not allow them to completely fill their crops until the last feed of the day, given shortly before they settle down for the night.

It is not necessary for the chicks to get full crops the first day on which they are fed, since they can, if necessary, live for at least four days without food, and if they have nearly all learnt to feed at the end of the day, even though they have not eaten very much, it will be quite satisfactory. The first day I give nothing but oatmeal, after which I supply small-size dry chick food, which contains a considerable proportion of oatmeal. I do not give bran or mash until the chicks are three weeks old.

When the chicks know their way about the brooder-house they may be allowed in the grass run outside. This will probably be when they are four or five days old. Again they must be watched, and any that do not find their way back must be returned to the brooder by the attendant. At one time I used to coax and guide the youngsters out into their run for the first time. Now I merely open the door and leave the birds to find their way out. At first they may be slow to do this, and for an hour or two only very few may take advantage of their greater liberty; but towards the end of the day, most of them will be running in and out. Having found their way out, they are much less likely to get lost in the run than chicks that have been persuaded to leave the brooder house. Whether or not the youngsters find their own way out, an eye must be kept on them, and any stragglers carried back to the warmth of the brooder.

I feel sure that a great deal of unnecessary mortality —which is almost certain to be blamed to B.W.D.—is caused by insufficient attention during the first few days before the chicks know their way about, in consequence of which they get chilled when lost in the cool room or the run. Young chicks are very quickly chilled, and if left away from the hover half-an-hour too long, may be seriously injured.

## FEEDING THE GREEN-STUFF.

Chicks require a regular supply of green food after they are four days old. If their run is well supplied with young and tender grasses, they should find all they need for themselves. In the early part of the year especially, rain or cold winds often keep the youngsters confined to the brooder, and when this is the case, green-stuff must be collected and given to them. Lawn clippings, dandelion leaves, lettuce and chick-weed are all splendid for even the youngest birds. The green food should be cut up very finely and fed on feeding-boards, which can also be used for giving mash. Greens of the cabbage tribe are said to be a little too strong for chicks under one month old, which it may scour.

Feeding-boards should be large enough to allow for all, or nearly all, of the chicks to be fed at one time. For a large flock of these youngsters several of these boards will be needed. These feeding-boards would probably be better described as trays, for they look like a roughly-made wooden tea-tray with a rim about 1½ inches deep. They are easily made on the farm, and it is advisable to give them a scrub over every day, after use. If this is done immediately, it is very little trouble, but if left for a day or two it is almost impossible to get them clean until they have been soaked in water for about one hour.

### DRINKING WATER.

Chicks require fresh water at least once a day, and it is better to supply it twice. Water vessels should be well cleaned out each time they are re-filled, and unless this is done they very quickly get coated with a film of slime, which is anything but healthy. Some poultry-keepers always " pink " the drinking-water with permanganate of potash. This is an excellent germicide, and cannot possibly harm the birds.

### MASH FOR THE CHICKS.

I do not give my chicks mash until they are three weeks old, when they are allowed access at all times to a mixture made up as follows: 3 cwt. bran, 2 cwt. middlings, 2 cwt. Sussex ground oats, ½ cwt. white fish-meal, 20 lbs. white bone-meal. The bone-meal, though only a small quantity is used, is an important ingredient. as it helps to produce strong bone formation in the chicks. Enough powdered charcoal is added to the mixture to give the whole a greyish colour.

My birds are reared almost entirely on dry food. though I find it sometimes helpful to give a brood of chicks that are inclined to be backward and want helping along, one meal a day of good biscuit meal, supplied wet. As a change this is always relished, and if the chicks are inclined to be off their dry food, as is sometimes the case in hot weather, the biscuit-meal will encourage their appetites.

If birds are to be fed on dry mash when they reach maturity, it is as well to rear them by the dry method. If they are given wet mash during the growing stage, and then changed over to dry on reaching the laying houses, they will almost certainly be checked immediately after the change is made.

## KEEPING THE YOUNGSTERS FIT.

Between the ages of one week and one month old, the chicks should be very carefully watched, so that the slightest tendency to falling off in condition can be observed at once. Strong, healthy youngsters should be almost unceasingly active in search of food, and always ready for their next meal. Their eyes are bright, their little tail-feathers carried erect, and their wings tight and close to the body.

If chicks spend much of their time in the warmest parts of the brooder, it is a sure sign that something is wrong, and that they are sick. Long, drooping wings, that appear too large for the chick, indicate serious digestive trouble, and it is a sign much dreaded by experienced poultry-keepers. This excessive " wingyness " is usually only noticed with light-breed birds, in which breeds the wing feathers develop at a very early age. In sick chicks these feathers grow quicker than the birds' bodies.

Once the chick's digestive system gets seriously out of order, irreparable damage is done. Even if the bird recovers, its growth will have been checked. It will be seen, then, that it is much more profitable to spend time in studying the chicks in order to avoid these troubles than in attempting to cure them once they are in evidence. As with all poultry aliments, the best treatment is to discover the cause of the trouble and then, if possible, remove it. Medicines are not very effective as a cure for bowel trouble in chicks. For chicks which are overfed, a mild dose of salts will be beneficial. For diarrhœa, I use the following mixture: 32 parts of Olive oil, 1 part Eucalyptus oil, 1 part Creosote. This mixture, and salts, are the only medicines I ever use for my chicks, unless indeed, charcoal is counted as such. Powdered charcoal is an excellent aid to digestion, and I always include it in my chick mash.

I have already touched upon the danger of over-feeding youngsters. It is a mistake that is very easily made by beginners. During the first two or three weeks of its life, the chick has a most voracious appetite, and it will continue to feed almost as long as there is food available. As a result, the digestive organs are not equal to the tax placed upon them, and in a brood which have been too heavily fed during the first week or two, it is usual to see many of the chicks with huge pendulous crops, staggering about on legs which seem too small for their bodies. In the next stage, the birds go off their food and " lose their legs." If they are examined the first thing in the morning, many of their crops will be found nearly full, and this is due to the fact that their intestines have become congested. Unless this can be remedied at once, death will follow.

The temperature of the hot compartment of the brooder should be gradually reduced as the chicks grow, the aim being to give the chicks sufficient warmth to keep them quite comfortable, and no more. Given too much heat the birds will become delicate, and show little inclination to leave the heated chamber for the much colder air outside. The chicks themselves provide the best guide to the correct temperature. If they are too cold they will stand crowded around the heater, chirping and drooping their wings. On the other hand, if they are too warm, they will get away from the source of heat. or, if this is not possible, will lie stretched full length on the floor with their beaks wide open, and panting.

Chicks are so easily damaged by chilling and overheating, which most often happens at night, that the attendant should always visit the brooder the last thing at night and satisfy himself that the lamps, or stoves, are properly regulated and supplied with sufficient fuel to keep them going until the morning. The absence of a lamp in a fireless brooder makes it unnecessary to visit chicks in these appliances after they have once been settled for the night. Readers who have had experience of a busy rearing season will appreciate what an advantage this is.

### COLONY HOUSE MANAGEMENT.

When six or eight weeks old, the chicks should be able to do without any artificial heat, and then leave the brooders for the colony rearing houses. In the earlier part of the season, or during a cold spell, it is advisable to let the youngsters remain a full eight weeks in the brooder house. When first moved into the unheated colony houses, the birds sometimes have a tendency to crowd, and if allowed to do so, some of them may be trampled on and suffocated, and many more " sweated." The corners of these houses should always be filled up with bundles of straw, and it is an excellent plan to improvise a hover by fastening some sacks over, and hanging down from, the perches. The chicks will sleep under the sacks, which will conserve their heat, and turn the house into a sort of cool brooder. At the end of ten days or a fortnight, the sacks can be removed, as by then the birds will be quite settled into their new quarters.

After the chicks leave the brooder there is no danger of over-feeding them, and they should be given all the food they can consume. The youngsters in my rearing houses are fed entirely from hoppers, which are never allowed to become completely empty. This hopper-feeding is a great saving of labour, as it is then only necessary to visit the birds once a day, except, of course, to open the houses in the morning and close them at night. The growing birds should have ample range of grass land, and when this is the case, they will get all the exercise they need in their runs—searching in the grass for insects and grubs.

When the chicks get eight or nine weeks old, their mash can be changed to a rather cheaper one. Half of the ground oats may be replaced with maize-meal, barley-meal, or good quality feed oatmeal. A little later the bone-meal can be omitted, and the bran might perhaps be cut down a third. This altered mash will then only differ very little from that which is being fed to the hens, and the birds can be kept on it until transferred to the laying houses.

From two months old onward the only grain I feed to my growing stock is wheat. Other grains are not eaten so well, and it is important, if the rate of growth is to be maintained, that the birds should be induced to eat as much as possible.

The pullets can be kept in the rearing houses until shortly before they commence to lay. However, when a start is made, pullets may be transferred to a laying shed at any time after they are ten weeks old. In this way some expenditure on colony houses can be avoided during the first year. The houses will have to be built the following year, as the laying sheds will be occupied until late in the autumn by the previous year's birds.

On some egg-farms combined brooders and rearing houses are used, and the birds are placed in these buildings when a day old, and remain there until they are transferred to the laying houses. This means, of course, that only one lot of chicks can pass through these combined houses in a season, and as more such buildings will be required, each with several alternate runs attached, the saving in capital outlay on rearing plant is not so great as might at first be supposed. These houses certainly save the labour which is entailed in moving chicks from the brooders to the colony houses.

## DRY CHICK FOODS.

Most dry chick foods contain a numerous and varied assortment of small and broken grains, which are brightly coloured, and give the food an attractive appearance. Broken rice, peas, lentils and hemp are found in many mixtures, but they are decidedly difficult to digest, and are not eaten by the chicks very readily, and are so best omitted. Kibbled wheat should form the bulk of a dry chick food, and may, in fact, form the whole of it, though a little more variety is preferable, especially in a small-sized food for use with chicks up to a month old. Pin-head oatmeal is a valuable though expensive ingredient, and a considerable percentage may be used with advantage. A little canary seed, kibbled maize and millet might complete the mixture.

A good supply of grit is necessary to the chicks, but it is not advisable to supply this in hoppers to quite young birds, as they are sometimes inclined to fill themselves up with it if it is constantly placed before them in bulk. I give my grit to chicks in brooders, broadcast in the litter, in exactly the same way as the chick food. A few handfuls once a week will suffice for several hundred birds. Once they are in the colony houses the grit may be fed in hoppers.

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